

SOIL SURVEY

San Diego Area, California

This is a scanned version of the text of the original soil survey report. The original maps are not included in this document. Although the original tables are included in this document, it is recommended that tables and maps be generated using SSURGO data from the Web Soil Survey or the Soil Data Mart, which contain the official data and information for the Field Office Technical Guide.

For additional information, please contact the California State Soil Scientist at (530) 792-5640.



UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service and Forest Service
in cooperation with
UNIVERSITY OF CALIFORNIA AGRICULTURAL EXPERIMENT STATION
UNITED STATES DEPARTMENT OF THE INTERIOR
Bureau of Indian Affairs
DEPARTMENT OF THE NAVY
United States Marine Corps

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Major fieldwork for this survey was completed in the period 1960-67. Soil names and descriptions were approved in 1967. Unless otherwise indicated, statements in the publication refer to conditions in the San Diego Area in 1969.

This survey was made cooperatively by the Soil Conservation Service and Forest Service; the University of California Agricultural Experiment Station; the Bureau of Indian Affairs; the United States Marine Corps; the Department of Housing and Urban Development; the County of San Diego Planning Department; and the Comprehensive Planning Organization. It was partly financed by the County of San Diego and the Department of Housing and Urban Development, under the provisions of Section 701 of the Housing Act of 1954, amended. It is part of the technical assistance furnished to the Soil Conservation Districts of San Diego County.

Part I of this survey provides basic information about the soils of the San Diego Area. It also contains data on climate, facts about farming, a section that describes broad patterns of soils in the Area, and an explanation of how the soils formed and how they are classified.

Part I of the survey is to be used along with Part II. Part II provides facts about use and management of the soils. Both parts are to be used with the detailed soil map, which is in a separate box.

Cover picture: Landscape of ridges and valleys in San Diego Area showing young avocado grove on Fallbrook soils and navel orange groves on Placentia and Fallbrook soils.

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SOIL SURVEY OF THE SAN DIEGO AREA, CALIFORNIA, PART I

(San Diego County excluding the Anza-Borrego and Cuyamaca State Parks)

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE AND FOREST SERVICE, IN COOPERATION

WITH THE UNIVERSITY OF CALIFORNIA AGRICULTURAL EXPERIMENT STATION, THE UNITED STATES DEPARTMENT OF

THE INTERIOR, BUREAU OF INDIAN AFFAIRS, THE DEPARTMENT OF THE NAVY, UNITED STATES MARINE CORPS, THE

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, AND THE COUNTY OF SAN DIEGO PLANNING DEPARTMENT

SAN DIEGO COUNTY, the most southwesterly county in the continental United States, is bounded on the west by the Pacific Ocean, on the north by Orange and Riverside Counties, on the east by Imperial County, and on the south by Mexico. The county is roughly 70 miles from east to west and 60 miles from north to south. The elevation ranges from sea level to 6,533 feet.

The Area surveyed (fig. 1) is approximately 2,204,880 acres. It excludes the Anza-Borrego and the Cuyamaca State Parks but includes a small part of Riverside County north of Palomar Mountain. The physiography, the climate, and the vegetation vary widely.

The coastal plains rise sharply to nearly level terraces, dissected terraces, and rolling hills that support a natural cover of coastal chaparral and grassland. In the narrow winding valleys, oak is the dominant vegetation. In the center of the Area are the foothills, the narrow intermediate valleys, the mountains, and the plateaus of the Peninsular Range province. Chaparral, open woodland, and isolated areas of open grassland make up the typical plant cover. The eastern part of the Salton Basin province is one of wide valleys separated by low irregular hills and mountains of multicolored beds of sandstone, shale, and conglomerate. The vegetation in this part is mainly a sparse cover of desert shrubs, cactus, and bunchgrass.

The climate ranges from mild marine along the coast to hot arid in the desert.

Since World War II, suburban expansion has transformed much of the farmland in the western third of the Area into urban-fringe areas. As a result, taxes and the cost of labor and real estate have increased out of proportion to farm income. Another factor that has added to the increased overhead is the high cost of importing water for irrigation from the Colorado River. Consequently, the only crops grown are those that have high gross returns

and do not compete with crops grown in other farming areas, or semitropical crops that are limited to a relatively frost-free climate, for example, avocados, citrus, flowers, tomatoes, truck crops, and other specialty crops.

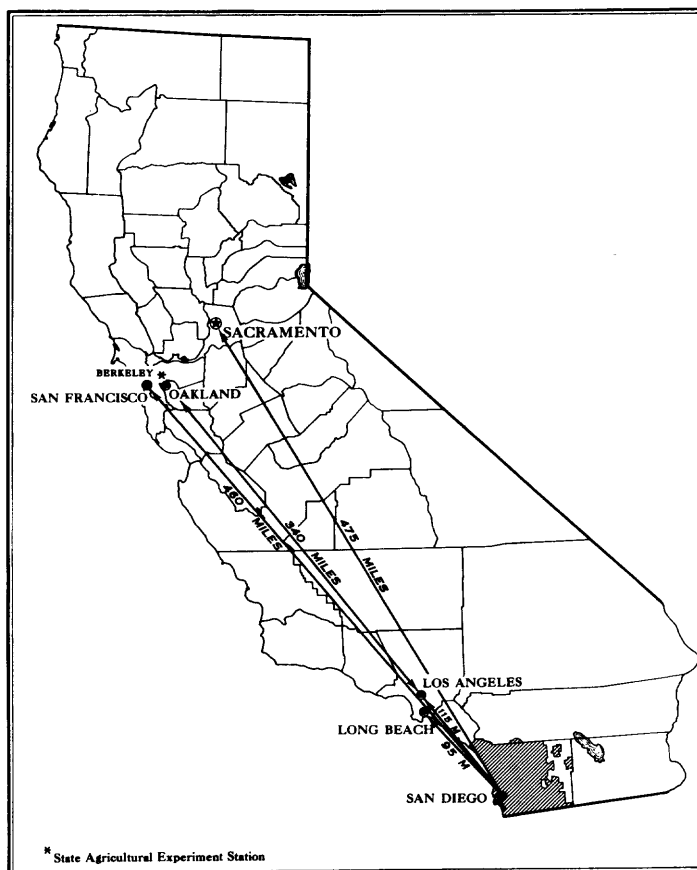


Figure 1.--Location of San Diego Area in California.

Poultry raising and dairying are important enterprises but occupy a very small acreage. No feed is raised on these farms. Dry lots, instead of pastures, are used in dairying. On poultry farms, the laying hens are caged throughout their

productive life.

Although 400,000 acres of the Area is used for range, ranching is not an important enterprise. Much of the range is chaparral vegetation, which yields low-quality forage.

CLIMATE^{1/}

Climatic data for the whole of San Diego County are discussed in this section, although the Anza-Borrego and the Cuyamaca State Parks were not covered by this soil survey (see figure 1).

The county has warm, dry summers and mild winters. It is made up of four physiographic provinces--the Coastal Plains, the Foothills, the Mountains, and the Desert. Temperature and precipitation data for each of these areas are given in table 1.

The Coastal Plains has the most equable climate of any area in the county; it has only light frost in winter. The Foothills have more variation in temperature and more precipitation than the Coastal Plains. The Mountain area has a wider range of temperature and receives more precipitation than either the Coastal Plains or the Foothills. The mean annual temperature is between 54° and 58° F. There is generally light snowfall in winter, but snow seldom stays on the ground for more than a few days. The Desert has the greatest variation in temperature and receives the least amount of precipitation of all the areas in the county.

Rainfall is heaviest during the period November to April and is infrequent in summer. The average total precipitation on the Coastal Plains is about 13 inches, and in the Mountains about 25 inches. The amount of rainfall diminishes rapidly down the

east slope of the Mountains and averages 5 inches in the Desert (fig. 2). Humidity is fairly high on the Coastal Plains in summer because of fog along the coast and is fairly low in the Desert on summer afternoons. The rest of the year it is moderate throughout the county.

Moderate temperatures prevail on the Coastal Plains. The growing season, or the period between the last freezing temperature in spring (fig. 3) and the first in fall (fig. 4), is 280 to 360 days. Sloping areas, which have the best air drainage and the least amount of frost, are desirable for avocados, citrus, and other frost-sensitive crops.

In the Foothills the growing season is 220 to 340 days. The mean annual temperature is between 59° and 63°. The average date of the first freeze in fall is December 1, and the last in spring February 1. Sloping areas, which have better air drainage and less frost than level areas, are desirable for avocados, citrus, and other frost-sensitive crops.

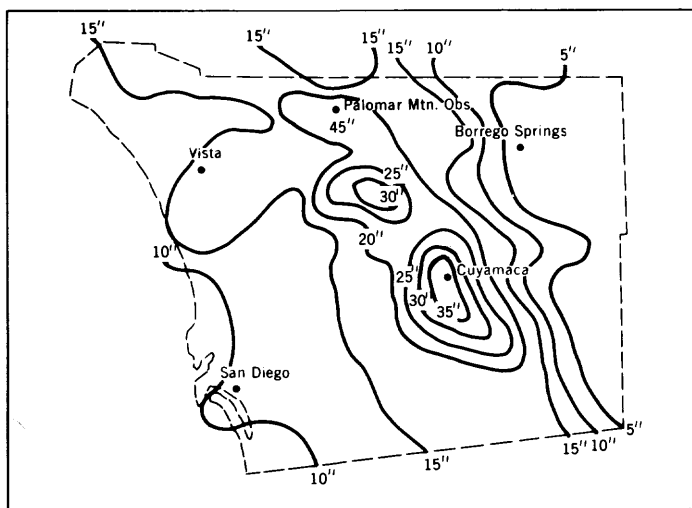


Figure 2.--Average seasonal precipitation.

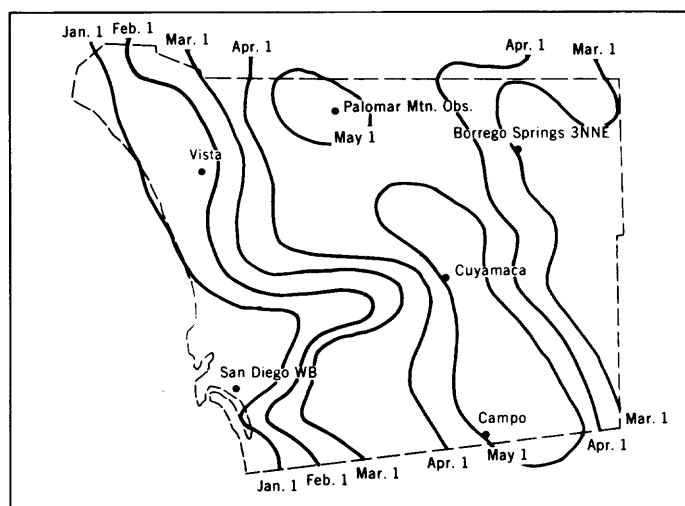


Figure 3.--Average date of last 32° temperature in spring.

^{1/}
By C. ROBERT ELFORD, State climatologist, and JOHN STILZ, assistant climatologist, National Weather Service, San Francisco, Calif.

In the Mountains the growing season is 150 to 200 days, which is the shortest in the county. The average dates of the first and the last freeze are November 1 and May 1, respectively. The mean maximum temperature in July is between 85° and 95°, and the mean minimum in January between 28° and 34°.

The growing season in the Desert is 210 to 260 days. The first freeze occurs about December 1, and the last about March 1. The mean maximum temperature in July is between 100° and 105°, and the mean minimum in January is 36°.

Winds are generally light; in fact, less than 8 miles per hour 64 percent of the time. Except for persistent westerly winds along the coast during summer afternoons, they vary in direction. Strong winds are associated with the east side of the Mountains, which slopes down to the Desert. The strongest winds are usually associated with occasional migrant storms that cross the county in winter.

Three or four times a year, usually in fall or in winter, pressure conditions cause a fairly strong, gusty flow of air from the north or east. This air is usually dry and at times is unseasonably warm.

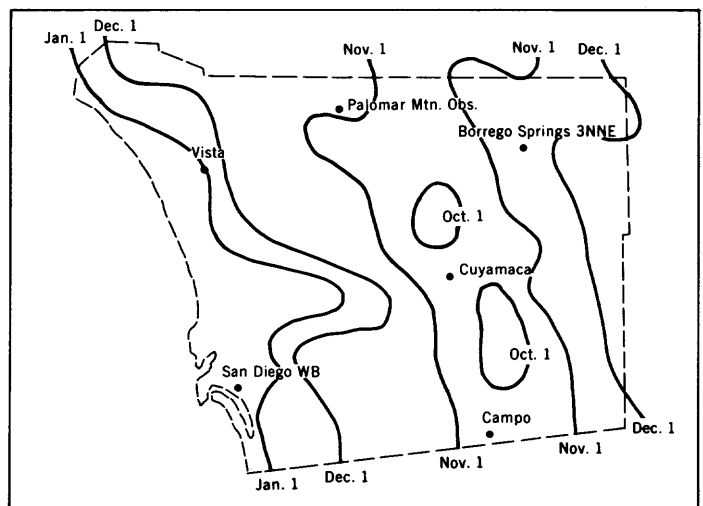


Figure 4.--Average date of first 32° temperature in fall.

FARMING

The Spanish introduced farming into San Diego County in 1769 with the establishment of Mission San Diego de Alcalá. Farming was limited to teaching the Indians to raise food for the Mission and for themselves. Primitive methods of irrigation were used during the long, dry summer. Mission San Luis Rey de Francia was established in 1798. Here too, limited farming was practiced to meet Mission needs.

The Missions also introduced livestock. In 1800, they had 450 head of cattle, 1,600 sheep, 148 horses, and 14 mules. By 1828, they had a total of 58,685 head of livestock. The main products to be marketed were hides and tallow.

Early in the 1800's, the land was taken from the Missions by the Spanish Governor of Alta California, diverted into Mexican land grants, and given to individuals.

In 1846, California became a territory of the United States. Production of beef became the most important industry. In 1885, railway service to the city of San Diego opened the county to rapid commercial development and new markets. Production of beef cattle declined, and production of grapes,

olives, and citrus expanded. Dairying and poultry raising enterprises soon followed.

In the 1920's, avocados were introduced. With the development of irrigation projects, land values, taxes, and water assessments increased the cost of farming and prompted the change from grapes and olives to avocados and citrus, which are of greater cash value.

Currently, farming is dominated by intensive specialized production of vegetables, fruits, flowers, eggs, and milk. Large acreages have executive-type management, specialized equipment, and highly organized labor skills, all of which result in very high gross returns per acre. Egg and milk production resembles an assembly-line, factory-type operation. Production per man-hour is very high. Only a small amount of land is needed in these operations. All feed is purchased from feed companies, and all products are moved rapidly to market.

For the past 15 years, large areas have been used for urban development. The coastal areas from Oceanside to the Mexican border and inland to El Cajon and Escondido are the most extensively urbanized.

TABLE 1.--TEMPERATURE AND PRECIPITATION DATA FOR FOUR WEATHER STATIONS IN SAN DIEGO AREA, CALIF.

[County of San Diego, Natural Resources Annual Report for years 1958-67. Data from National Weather Service]

Coastal plain: San Diego, Calif.
[Elevation 19 feet]

Month	Temperature						Precipitation
	Mean high	Mean low	Monthly mean	Highest	Lowest	Days 32° F. or below	Total
	°F.	°F.	°F.	°F.	°F.	No.	In.
January-----	66.3	47.1	56.7	83	31	0.1	1.29
February-----	66.3	48.9	57.6	85	38	0	1.45
March-----	66.3	51.0	58.7	88	42	0	1.14
April-----	71.9	55.6	63.8	86	47	0	1.65
May-----	69.1	57.4	63.3	91	48	0	0.15
June-----	70.7	60.0	65.4	85	51	0	0.06
July-----	75.6	63.9	69.8	93	57	0	0.03
August-----	78.0	66.2	72.1	89	61	0	0.02
September----	77.4	64.0	70.7	111	56	0	0.30
October-----	75.9	59.5	67.7	107	48	0	0.14
November-----	69.9	53.0	61.5	97	38	0	1.53
December-----	66.5	48.1	57.3	88	35	0	1.61
Year-----	71.2	56.2	63.2	111	31	0.1	9.34

Foothills: Escondido, Calif.
[Elevation 700 feet]

January-----	66.9	37.8	52.4	86	23	7.6	1.67
February-----	67.2	40.4	53.8	92	28	2.5	2.30
March-----	68.3	42.7	55.5	89	29	1.0	2.07
April-----	73.1	46.6	59.9	97	35	0	1.71
May-----	75.6	51.1	63.3	97	39	0	0.24
June-----	80.1	55.0	67.6	96	41	0	0.07
July-----	87.8	58.5	73.1	105	47	0	0.07
August-----	88.5	61.1	74.9	103	50	0	0.05
September----	84.8	57.6	71.2	105	45	0	0.39
October-----	80.2	52.0	66.1	101	38	0	0.31
November-----	71.3	44.2	57.8	93	25	0.9	2.26
December-----	67.3	39.6	53.5	89	26	3.5	2.35
Year-----	75.1	48.9	62.4	105	23	15.5	13.49

Mountains: Palomar Observatory, Calif.
[Elevation 5,515 feet]

January-----	54.6	33.9	44.3	78	13	$\frac{1}{11.8}$	2.95
February-----	54.9	34.1	44.5	76	15	12.1	3.92
March-----	56.6	34.4	45.5	82	16	14.1	3.61
April-----	62.5	39.1	50.8	83	22	9.5	3.77
May-----	68.5	43.9	55.2	88	24	3.2	0.35
June-----	77.0	54.4	64.7	93	28	0.9	0.11
July-----	84.2	60.8	72.6	95	49	0	0.27
August-----	84.8	60.8	72.8	94	38	0	0.37
September----	79.9	54.4	67.2	93	35	0	0.73
October-----	74.3	49.2	61.8	90	24	0.9	0.40
November-----	61.8	39.5	50.7	80	17	5.8	4.49
December-----	56.3	35.6	46.0	80	10	$\frac{1}{8.6}$	5.37
Year-----	68.1	45.0	56.3	95	10	66.9	26.34

TABLE 1.--TEMPERATURE AND PRECIPITATION DATA FOR FOUR WEATHER STATIONS IN SAN DIEGO AREA, CALIF.--Continued

Desert: Borrego Springs, Calif.
[Elevation 500 feet]

Month	Temperature						Precipitation
	Mean high	Mean low	Monthly mean	Highest	Lowest	Days 32° F. or below	Total
	<u>°F.</u>	<u>°F.</u>	<u>°F.</u>	<u>°F.</u>	<u>°F.</u>	<u>No.</u>	<u>In.</u>
January-----	69.5	36.7	53.1	89	20	7.9	0.25
February-----	73.4	41.8	57.6	91	25	2.3	0.43
March-----	76.9	45.9	61.4	93	26	0.6	0.26
April-----	83.8	51.4	67.6	102	37	0	0.14
May-----	90.4	56.9	73.7	111	40	0	0.02
June-----	98.9	63.7	81.3	115	48	0	0.00
July-----	105.1	70.8	88.0	117	55	0	0.13
August-----	103.5	71.5	87.5	114	56	0	0.26
September-----	<u>1/</u> 88.6	<u>1/</u> 56.5	<u>1/</u> 72.6	<u>1/</u> 111	<u>1/</u> 42	0	0.21
October-----	<u>1/</u> 81.5	<u>1/</u> 49.9	<u>1/</u> 65.7	<u>1/</u> 105	<u>1/</u> 37	0	0.35
November-----	77.0	45.9	61.4	97	23	0.9	0.61
December-----	69.8	38.7	54.3	89	21	3.8	0.61
Year-----	84.9	52.5	68.7	117	20	15.5	3.27

1/
Based on 9 years reporting.

Soil scientists surveyed the San Diego Area to learn what kinds of soil are in the Area, where they are located, and how they can be used. The soil scientists went into the Area knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in areas nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The soil series and the soil phase are the categories of soil classification most used in a local survey (10). ^{2/}

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Escondido and Fallbrook, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Escondido very fine sandy loam, 9 to 15 percent slopes, eroded, is one of several phases within the Escondido series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map of the

San Diego Area was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. One such kind of mapping unit, a soil complex, is shown on the soil map of the San Diego Area.

A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Fallbrook-Vista sandy loams, 15 to 30 percent slopes, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Riverwash is a land type in the San Diego Area.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data are given in Part I of this survey. (All engineering interpretations are in Part II.) Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil. Yields under defined management are estimated for all the soils. (The estimates are shown in Part II.)

The soil scientists set up trial groups of soils on the basis of yield and practice tables and other data they have collected. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. Then they adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management. The descriptions of all groups and suggestions about use and management of the soils in each group are to be found in Part II of this survey.

^{2/} Underscored numbers in parentheses refer to Literature Cited, page 101.

GENERAL SOIL MAP

The general soil map (see box containing detailed soil maps) shows, in color, the soil associations in the San Diego Area. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in an Area, who want to compare different parts of an Area, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is also useful in determining the value of an association for a watershed, for wildlife habitat, for engineering projects, for recreational areas, and for community development. A general soil map is not suitable for planning the management of a farm or field, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect management.

The San Diego Area has been divided into four major physiographic provinces--the Desert, the Mountains, the Foothills, and the Coastal Plains. These provinces reflect differences in climate, soils, and land use. The four provinces are outlined on the general soil map and are described in detail in the section "Formation, Morphology, and Classification of the Soils."

The 34 soil associations in the San Diego Area have been assigned to 8 groups. The grouping is based on soil characteristics and qualities and on location of the associations in the specified physiographic province. All groups and associations are described in the following pages.

Group I. Excessively Drained to Well-Drained, Nearly Level to Moderately Sloping Very Gravelly Sands to Silt Loams on Alluvial Fans in Desert Areas

The soils in this group are excessively drained to well-drained very gravelly sands, loamy coarse sands, sandy loams, and silt loams. They formed in material derived from acid igneous rock and mica schist. Slopes range from 0 to 9 percent.

The elevation ranges from 100 to 2,500 feet. The average annual rainfall is between 3 and 8 inches, and the average annual air temperature between 70° and 74° F. The frost-free season is 240 to 275 days. The vegetation consists of desert shrubs, cactus, and scattered annual grasses and forbs.

These soils are used for irrigated cotton, dates, alfalfa, citrus, and pasture. Unless irrigation water is available, they produce only a limited amount of forage for livestock.

Three associations of the San Diego Area are in this group. They represent all of the cultivated acreage in the Desert and make up about 5 percent of the Area.

1. Mecca-Indio Association

Well-drained sandy loams and silt loams on alluvial fans, subject to occasional flooding and deposition; 0 to 5 percent slopes

This association is made up of soils that developed in alluvium derived from acid igneous rock and mica schist. It occurs in the Desert. The elevation ranges from 100 to 2,500 feet. The mean annual precipitation is between 3 and 8 inches, and the mean annual air temperature between 70° and 74° F. The frost-free season is 220 to 275 days. The vegetation consists mostly of desert shrubs, cactus, and annual grasses.

This association occupies about 1 percent of the San Diego Area. Mecca soils make up about 50 percent of the association, and Indio soils about 40 percent. Rositas and Carrizo soils and small areas of moderately to strongly saline Indio soils make up the remaining 10 percent.

Mecca soils are brown and yellowish-brown coarse sandy loams, sandy loams, or fine sandy loams. Indio soils are pale-brown silt loam to a depth of about 45 inches, and below this, pale-brown fine sandy loam. Both soils are slightly saline. Free water is seldom close enough to the surface to create a problem.

Irrigated areas are used for crops, most commonly cotton, dates, alfalfa, and small grain. Non-irrigated areas are used for range.

2. Rositas-Carrizo Association

Somewhat excessively drained and excessively drained loamy coarse sands to very gravelly sands on alluvial fans; 0 to 2 percent slopes

This association is made up of soils that developed in alluvium derived from acid igneous rock and mica schist. It occurs in the Desert. The elevation ranges from 100 to 2,000 feet. The mean annual precipitation is between 4 and 7 inches, and the mean annual air temperature between 68° and 74° F. The frost-free season is 210 to 270 days. The vegetation consists mostly of desert shrubs, cactus, and annual grasses.

This association occupies about 2 percent of the San Diego Area. Rositas soils make up about 50 percent of the association, and Carrizo soils about 35 percent. Mecca soils, Indio soils, and sand dunes make up the remaining 15 percent.

Rositas soils are somewhat excessively drained, light brownish-gray loamy coarse sands and fine sands. They have a substratum of pale-brown fine gravelly loamy coarse sand to fine sand. Carrizo soils are excessively drained, very pale brown very gravelly sands. They have a substratum of very pale brown very gravelly coarse sand.

Carrizo soils are marginal for irrigated farming, but they provide a good source of sand and gravel for construction purposes. Irrigated areas of

Rositas soils are used for vineyards, citrus, pasture, and alfalfa. Nonirrigated areas are used for range. Some areas are subject to occasional overflow.

3. Rositas-Carrizo Association

Somewhat excessively drained and excessively drained loamy coarse sands to very gravelly sands on alluvial fans; 2 to 9 percent slopes

This association is made up of soils that developed in alluvium derived from acid igneous rock and mica schist. It occurs in the Desert. The elevation ranges from 100 to 2,000 feet. The mean annual precipitation is between 4 to 7 inches, and the mean annual air temperature between 68° and 74° F. The frost-free season is 210 to 270 days. The vegetation consists mostly of desert shrubs, cactus, and annual grasses.

This association occupies about 2 percent of the San Diego Area. Rositas soils make up about 60 percent of the association, and Carrizo soils about 25 percent. Mecca soils and small areas of sand dunes make up the remaining 15 percent.

Rositas soils are somewhat excessively drained, light brownish-gray loamy coarse sands and fine sands that have a substratum of pale-brown fine gravelly loamy coarse sand. Carrizo soils are excessively drained, very pale brown very gravelly sands and fine sands. They have a substratum of very pale brown very gravelly coarse sand.

Irrigated areas of Rositas soils are used for citrus, alfalfa, and pasture. Nonirrigated areas are used for range. Carrizo soils are too coarse textured for irrigated farming, but they provide a good source of sand and gravel for construction purposes.

Group II. Excessively Drained to Well-Drained, Gently Sloping to Strongly Sloping Loamy Coarse Sands to Sandy Loams on Alluvial Fans and in Basins in Mountainous Areas

The soils in this group are excessively drained to well-drained loamy coarse sands, coarse sandy loams, and sandy loams. They formed in material derived from granitic rock. Slopes range from 2 to 15 percent.

The elevation ranges from 2,500 to 4,500 feet. The average annual precipitation is between 11 and 22 inches, and the average annual air temperature between 56° and 59° F. The frost-free season is 150 to 200 days. The vegetation consists of annual grasses and forbs, shrubs, and scattered California oaks.

These soils are used mainly for range. A limited acreage is used for dryfarmed hay and grain.

Two associations of the San Diego Area are in this group. They represent 4 percent of the Area.

4. Mottsville-Bull Trail Association

Excessively drained to well-drained loamy coarse sands and sandy loams on alluvial fans and in basins; 2 to 15 percent slopes

This association is made up of soils that developed in alluvium derived from granitic rock and old granitic sand. It occurs in the Mountains. The elevation ranges from 2,500 to 4,500 feet. The mean annual precipitation is between 14 and 22 inches, and the mean annual air temperature between 56° and 59° F. The frost-free season is 150 to 200 days. The vegetation consists of soft chess, stipa, flat-top buckwheat, riggut brome, annual forbs and grasses, and a few California live oaks.

This association occupies about 2 percent of the San Diego Area. Mottsville soils make up about 60 percent of the association, and Bull Trail soils about 30 percent. Calpine and La Posta soils make up the remaining 10 percent.

Mottsville soils are excessively drained, grayish-brown loamy coarse sands. They have a substratum of brown loamy coarse sand. Bull Trail soils are well-drained, grayish-brown sandy loams. They have a subsoil of brown sandy clay loam. Below this is pale-brown sand.

These soils are used mostly for range. A few small areas are seeded to grain for hay or pasture.

5. Mottsville-Calpine Association

Excessively drained to well-drained loamy coarse sands and coarse sandy loams on alluvial fans; 2 to 15 percent slopes

This association is made up of soils that developed in alluvium derived from granitic rock. It occurs in the Mountains. The elevation ranges from 2,500 to 4,500 feet. The mean annual precipitation is between 8 and 20 inches, and the mean annual air temperature between 56° and 59° F. The frost-free season is 150 to 200 days. The vegetation consists of chamise, scrub oak, manzanita, sagebrush, flattop buckwheat, annual grasses and forbs, and a few California live oaks.

This association occupies about 2 percent of the San Diego Area. Mottsville soils make up about 60 percent of the association, and Calpine soils about 30 percent. Bull Trail, Kitchen Creek, and La Posta soils make up the remaining 10 percent.

Mottsville soils are excessively drained, grayish-brown loamy coarse sands. They have a substratum of brown loamy coarse sand. Calpine soils are well-drained, dark grayish-brown coarse sandy loams. They have a subsoil of brown coarse sandy loam and a substratum of brown, stratified sand and gravel.

These soils are used mostly for range. Small areas are seeded to grain for hay and pasture.

Group III. Excessively Drained to Moderately Well Drained, Nearly Level to Moderately Sloping Loamy Sands to Clays on Alluvial Fans and Alluvial Plains in Foothill and Coastal Plain Areas

The soils in this group are excessively drained to moderately well drained sands, loamy sands, sandy loams, gravelly sandy loams, clay loams, and clays. They formed in material derived from marine sandstone and shale and granitic rock. Slopes range from 0 to 9 percent.

The elevation ranges from near sea level to 2,000 feet. The average annual rainfall is between 10 to 18 inches, and the average annual air temperature between 60° and 62° F. The frost-free season is 240 to 340 days. The vegetation consists of annual grasses and forbs, shrubs, and scattered oaks.

These soils are used for flowers, citrus, truck crops, nursery stock, and range. Urbanization is expanding in many areas.

Two associations of the San Diego Area are in this group. They represent about 4 percent of the Area.

6. Salinas-Corralitos Association

Moderately well drained to somewhat excessively drained clays, clay loams, and loamy sands on alluvial fans; 0 to 9 percent slopes

This association is made up of soils that developed in alluvium derived from marine sandstone and sediments washed from adjacent soils. It is on the Coastal Plains. The elevation ranges from 25 to 300 feet. The mean annual precipitation is between 10 and 14 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 300 to 340 days. There is only light frost in winter. The vegetation consists mostly of red brome, ripgut brome, flattop buckwheat, sumac, annual grasses and forbs, and scattered trees.

This association occupies about 1 percent of the San Diego Area. Salinas soils make up about 60 percent of the association, and Corralitos soils about 30 percent. Chino and Tujunga soils make up the remaining 10 percent.

Salinas soils are well drained and moderately well drained, dark grayish-brown clay loams or clays. They have a substratum of very dark grayish-brown clay loam and clay. Corralitos soils are somewhat excessively drained, grayish-brown loamy sands. They have a substratum of brown loamy sand.

These soils are used mostly for flowers and truck crops; a large variety of flowers and vegetables is grown under intensive management. Urbanization is advancing into this association along the coastal area.

7. Visalia-Tujunga Association

Moderately well drained and excessively drained sandy loams to sands on alluvial fans and alluvial plains; 0 to 9 percent slopes

This association is made up of soils that developed in alluvium derived predominantly from granitic

rock. It is on the Coastal Plains and in the Foothills. The elevation ranges from sea level to 2,000 feet. The mean annual precipitation is between 10 and 18 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 240 to 320 days. The vegetation consists mostly of annual grasses and forbs and a few scattered oaks.

This association occupies about 3 percent of the San Diego Area. Visalia soils make up about 60 percent of the association, and Tujunga soils about 25 percent. Ramona, Placentia, Fallbrook, and Vista soils and Clayey alluvial land make up the remaining 15 percent.

Visalia soils are moderately well drained, dark grayish-brown sandy loams or gravelly sandy loams. They have a substratum of dark grayish-brown sandy loam or gravelly sandy loam. Tujunga soils are excessively drained, brown sands. They have a substratum of pale-brown sand.

These soils are used mostly for truck crops, flowers, citrus, nursery stock, and range. Flowers and nursery stock are grown near the coast. Citrus and truck crops are grown inland as well as in the coastal area. Urban, industrial, and recreational uses are increasing, even though flooding is a hazard in some parts of this association.

Group IV. Somewhat Excessively Drained to Moderately Well Drained, Nearly Level to Steep Loamy Coarse Sands to Clay Loams on Terraces in Foothill and Coastal Plain Areas

The soils in this group are somewhat excessively drained to moderately well drained loamy coarse sands to gravelly clay loams that have a loamy coarse sand to clay subsoil. In some areas these soils are underlain by a hardpan. They formed in alluvium derived from a variety of rocks. Slopes are generally between 2 and 15 percent but range from 0 to 50 percent.

The elevation ranges from near sea level to 1,800 feet. The average annual rainfall is between 10 and 18 inches, and the average annual air temperature between 60° and 62° F. The frost-free season is 260 to 350 days. The vegetation consists of annual grasses and forbs, shrubs, and a few scattered oaks.

The soils on the Coastal Plains are used for irrigated citrus, truck crops, flowers, and avocados, and those in the Foothills for irrigated citrus and pasture. Undeveloped areas are used for range. Urban use is increasing.

Five associations of the San Diego Area are in this group. They make up about 11 percent of the Area.

8. Ramona-Placentia Association

Well drained and moderately well drained sandy loams that have a subsoil of sandy clay loam to sandy clay over granitic alluvium; 2 to 15 percent slopes

This association is made up of soils that developed in alluvium derived from granitic rocks. It is in the Foothills. The elevation ranges from 200 to 1,800 feet. The mean annual precipitation is between 14 and 18 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 260 to 320 days. The vegetation consists mostly of soft chess, wild oats, filaree, barley, chamise, annual forbs, and a few scattered oaks.

This association occupies about 2 percent of the San Diego Area. Ramona soils make up about 55 percent of the association, and Placentia soils about 35 percent. Bonsall, Fallbrook, and Visalia soils make up the remaining 10 percent.

Ramona soils are well drained. They have a surface layer of yellowish-brown sandy loam and gravelly sandy loam and a subsoil of brown sandy clay loam. Placentia soils are moderately well drained. They have a surface layer of brown sandy loam and a subsoil of brown sandy clay. Both soils overlie yellowish-brown coarse sandy loam to sandy clay loam.

These soils are used for citrus, pasture, dry-farmed grain, and range. Urban use is increasing.

9. Marina-Chesterton Association

Somewhat excessively drained to moderately well drained loamy coarse sands and fine sandy loams that have a subsoil of sandy clay over a hardpan; 2 to 15 percent slopes

This association is made up of soils that developed in ferruginous, windworked, weakly consolidated sand. It occurs on broad rolling ridges parallel to the coast. The elevation ranges from sea level to 400 feet. The mean annual precipitation is between 10 and 14 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 330 to 350 days. The winter growing season has infrequent light frosts. Semitropical plants and winter vegetables are seldom damaged. The vegetation consists mostly of chamise, sumac, black sage, flattop buckwheat, and annual grasses and forbs.

This association occupies about 2 percent of the survey area. Marina soils make up about 45 percent of the association, and Chesterton soils about 35 percent. Las Flores and Huerhuero soils and Coastal beaches make up the remaining 20 percent.

Marina soils are somewhat excessively drained. They have a surface layer of dark yellowish-brown loamy coarse sand and a subsoil of strong-brown loamy coarse sand. Chesterton soils are moderately well drained. They have a surface layer of brown fine sandy loam, a subsoil of mottled red, brown, and gray sandy clay, and below this, an iron-silica cemented hardpan.

The soils of this association are used for truck crops, flowers, citrus, and avocados. Urban use is increasing along the coast.

10. Huerhuero-Stockpen Association

Moderately well drained loams to gravelly clay loams that have a subsoil of clay or gravelly clay; 0 to 9 percent slopes

This association is made up of soils that developed on marine terraces in sandy to clayey marine sediments. It occurs on the Coastal Plains. The elevation ranges from sea level to 400 feet. The mean annual precipitation is between 10 and 12 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 300 to 350 days. The vegetation consists of tarweed, Russian-thistle, wild oats, red brome, and other annual grasses and forbs.

This association occupies about 2 percent of the survey area. Huerhuero soils make up about 75 percent of this association, and Stockpen soils about 15 percent. Las Flores soils, Olivenhain soils, and Urban land make up the remaining 10 percent.

Huerhuero soils have a surface layer of brown loam and a subsoil of brown clay. Stockpen soils have a surface layer of light-gray gravelly clay loam and a subsoil of gray gravelly clay. Both soils overlie yellowish-brown loamy sand to olive-gray clay.

These soils are used for truck crops, flowers, housing developments, and range. Damage from winter frost is slight.

11. Redding Association

Well-drained cobbly loams and gravelly loams that have a gravelly clay subsoil over a hardpan; 2 to 9 percent slopes

This association is made up of undulating to gently rolling soils that formed on gravelly marine terraces. It occurs on the Coastal Plains. Typically, there are many broad-based hummocks, locally called mimamounds. The elevation ranges from 200 to 500 feet. The mean annual precipitation is between 10 and 15 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 290 to 330 days. The vegetation consists mostly of chamise, flattop buckwheat, sumac, scrub oak, and annual forbs and grasses.

This association occupies about 1 percent of the survey area. Redding soils make up about 90 percent of the association. Olivenhain soils, Chesterton soils, and small areas of Terrace escarpments make up the remaining 10 percent.

Redding soils have a surface layer of light-brown cobbly loam and gravelly loam, a subsoil of red gravelly clay, and below this, an iron-silica cemented hardpan. The pan is not uniform or continuous. Following normal rainy periods, water is ponded in areas between the mounds.

These soils are of little value for farming and ranching. Open areas are mainly idle. Industrial and urban developments occupy large areas and are continuing to expand in the area of Clairemont and Miramar.

12. Redding-Olivenhain Association

Well-drained gravelly loams and cobbly loams that have a subsoil of gravelly clay and very cobbly clay over a hardpan or cobbly alluvium; 9 to 50 percent slopes

This association is made up of soils that developed on old gravelly and cobbly marine terraces deeply dissected by numerous drainageways. It occurs on the Coastal Plains. It is characterized by tortuous divides and deep V-shaped valleys that have steep side slopes. The elevation ranges from 100 to 600 feet. The mean annual precipitation is between 10 and 16 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 290 to 330 days. The vegetation consists of chamise, sumac, flatter buckwheat, sugarbush, and annual forbs and grasses.

This association occupies about 4 percent of the San Diego Area. Redding soils make up about 45 percent of the association, and Olivenhain soils about 40 percent. Huerhuero soils, Gaviota soils, and Terrace escarpments make up the remaining 15 percent.

Redding soils have a surface layer of light-brown cobbly loam and gravelly loam, a subsoil of red gravelly clay, and, below this, an iron-silica cemented hardpan. The hardpan is not continuous; generally it does not occur at the base of steep slopes. Olivenhain soils have a surface layer of brown cobbly loam and a subsoil of reddish-brown very cobbly clay. They are underlain by cobbly loam alluvium.

These soils are used for watershed and military testing grounds. A limited acreage is in range. In a few small areas, the landscape has been reshaped and used for urban developments. Urban development is difficult because of the gravelly and cobbly texture, the steep topography, and the hardpan.

Group V. Excessively Drained to Well-Drained, Moderately Sloping to Very Steep Loamy Coarse Sands to Loams on Uplands in Mountainous Areas

The soils in this group are excessively drained to well-drained loamy coarse sands to loams. They formed in material derived from mica schist, gabbro, granodiorite, and quartz diorite. Slopes range from 5 to 75 percent. In many areas these soils are eroded. In most areas rock outcrops or stones cover 2 to 10 percent of the surface.

The elevation ranges mainly from 2,000 to 6,000 feet. Some peaks rise above 6,000 feet. The average annual precipitation is between 12 and 38 inches, and the average annual air temperature between

53° and 58° F. The frost-free season is 135 to 230 days. The vegetation consists mainly of coniferous woodland or chaparral and an understory of annual grasses and forbs.

These soils are used for range, wildlife habitat, and watershed. Some small areas are used for apple and pear orchards. Others are used as recreational areas and cabin sites.

Seven of the associations in the San Diego Area are in this group. They occupy about 26 percent of the Area.

13. Holland-Boomer Association, Stony

Well-drained stony fine sandy loams and stony loams that have a subsoil of sandy clay loam and stony clay loam over weathered micaceous schist and decomposed gabbro; 9 to 60 percent slopes

This association is made up of strongly sloping to very steep soils that developed in material weathered in place from mica schist and gabbro. It occurs in the Mountains. The elevation ranges from 3,200 to 5,600 feet. The mean annual precipitation is between 25 and 38 inches, and the mean annual air temperature between 53° and 56° F. The frost-free season is 135 to 200 days. The vegetation is chiefly coniferous woodland, shrubs, and an understory of annual and perennial grasses.

This association occupies about 3 percent of the San Diego Area. Holland soils make up about 50 percent of the association, and Boomer soils about 35 percent. Sheephead soils, La Posta soils, and rock land make up the remaining 15 percent.

Holland soils have a surface layer of yellowish-brown stony fine sandy loam and fine sandy loam and a subsoil of brown sandy clay loam. Below this is weathered micaceous schist. Boomer soils have a surface layer of reddish-brown stony loam and loam and a subsoil of yellowish-red stony clay loam. Below this is decomposed gabbro. A few boulders and rock outcrops occur throughout the association.

These soils are used mainly for range, woodland, wildlife habitat, and watershed. A few small areas are used for apple and pear orchards. Wooded areas are used as recreational areas and as sites for summer cottages.

14. Crouch Association, Rocky

Well-drained coarse sandy loams over weathered granodiorite; 9 to 30 percent slopes

This association is made up of soils that developed in material weathered from granodiorite. It occurs in the Mountains. The elevation ranges mainly from 3,000 to 6,000 feet. Some peaks rise above 6,000 feet. The mean annual precipitation is between 20 and 35 inches, and the mean annual air temperature between 53° and 55° F. The frost-free season is 135 to 175 days. The vegetation consists of

open stands of mixed coniferous and deciduous trees and an understory of shrubs and grasses.

This association occupies 2 percent of the San Diego Area. Crouch soils make up about 90 percent of the association. Holland soils, La Posta soils, and Loamy alluvial land make up the remaining 10 percent.

Crouch soils have a surface layer of dark grayish-brown coarse sandy loam and a subsoil of yellowish-brown sandy loam. They overlie weathered granodiorite that is several feet thick. Rock outcrops, stones, and boulders cover about 2 to 10 percent of the surface.

These soils are used mainly for range, wildlife habitat, and watershed. The woodland on this association is of little or no importance in the production of timber. Wooded areas are used as recreational areas and as sites for summer cottages.

15. Crouch Association, Rocky

Well-drained coarse sandy loams over weathered granodiorite; 30 to 75 percent slopes

This association is made up of soils that developed in material derived from granodiorite. It occurs in the Mountains. The elevation ranges from 3,000 to 8,000 feet. The mean annual precipitation is between 20 and 35 inches, and the mean annual air temperature between 53° and 55° F. The frost-free season is 135 to 175 days. The vegetation consists of open stands of mixed coniferous and deciduous trees and an understory of shrubs and grasses.

This association occupies 2 percent of the San Diego Area. Crouch soils make up about 85 percent of the association. La Posta soils, Sheephead soils, and areas of rock land make up the remaining 15 percent.

Crouch soils have a surface layer of dark grayish-brown coarse sandy loam and a subsoil of yellowish-brown sandy loam. They overlie weathered granodiorite that is several feet thick. Rock outcrops and boulders cover about 2 to 10 percent of the surface.

These soils are used mostly for range, wildlife habitat, watershed, and recreational areas. The woodland on this association is of little or no importance in the production of timber.

16. La Posta-Kitchen Creek Association, Rocky, Eroded

Somewhat excessively drained loamy coarse sands over decomposed granodiorite; 5 to 15 percent slopes

This association is made up of soils that developed in material derived from granitic rock. It occurs on uplands in the Mountains. The elevation

ranges from 2,000 to 4,500 feet. The mean annual precipitation is between 12 and 20 inches, and the mean annual air temperature between 56° and 58° F. The frost-free season is 160 to 190 days. The vegetation consists of chaparral, mainly chamise, red shank, scrub oak, and flattop buckwheat.

This association occupies about 2 percent of the San Diego Area. La Posta soils make up about 70 percent of the association, and Kitchen Creek about 20 percent. Mottsville and Tollhouse soils make up the remaining 10 percent.

La Posta soils have a surface layer of grayish-brown loamy coarse sand and a substratum of brown loamy coarse sand. Below this is decomposed granodiorite. Rock outcrops and boulders cover 2 to 10 percent of the surface. Kitchen Creek soils have a surface layer of dark-brown loamy coarse sand and a subsoil of pale-brown coarse sandy loam. Below this is decomposed granodiorite.

These soils are used mainly for range, wildlife habitat, and watershed. Large areas would be suitable for farming or for housing developments if water could be made available.

17. Tollhouse-La Posta-Rock Land Association, Eroded

Excessively drained and somewhat excessively drained coarse sandy loams and loamy coarse sands over granitic rock, and areas of rock land; 9 to 65 percent slopes

This association is made up of soils that developed in material derived from decomposed granodiorite. It occurs on uplands in the Mountains. The elevation ranges from 2,000 to 5,000 feet. The mean annual precipitation is between 15 and 20 inches, and the mean annual air temperature between 56° and 58° F. The frost-free season is 140 to 190 days. The vegetation is mainly chaparral and a few annual grasses and forbs.

This association occupies about 9 percent of the San Diego Area. Tollhouse soils make up about 45 percent of the association, La Posta soils about 35 percent, and Acid igneous rock land about 10 percent. Sheephead and Mottsville soils make up the remaining 10 percent.

Tollhouse soils are excessively drained. They have a surface layer of dark grayish-brown coarse sandy loam that is underlain by hard granitic rock. La Posta soils are somewhat excessively drained. They have a surface layer of grayish-brown loamy coarse sand and a substratum of brown loamy coarse sand that is underlain by weathered granodiorite. Rock land consists of areas where 50 to 90 percent of the surface is covered with boulders and outcrops of acid igneous rock. Very shallow soil material occurs in pockets between the rocks.

The soils of this association are used mainly for range, watershed, and wildlife habitat.

18. Sheephead Association, Rocky

Well-drained cobbly fine sandy loams over fractured mica schist; 9 to 65 percent slopes

This association is made up of soils that developed in material derived from mica schist. It occurs in the Mountains. The elevation ranges from 3,000 to 6,000 feet. The mean annual precipitation is between 20 and 30 inches, and the mean annual air temperature between 56° and 58° F. The frost-free season is 160 to 185 days. The vegetation is chaparral, including chamise and manzanita, and a few annual grasses.

This association occupies about 1 percent of the San Diego Area. Sheephead soils make up about 70 percent of the association. Tollhouse and Holland soils make up the remaining 30 percent.

Sheephead soils have a surface layer of dark grayish-brown cobbly fine sandy loam. Below this is fractured mica schist. Rock outcrop covers 2 to 10 percent of the surface.

These soils are used mainly for range, watershed, and wildlife habitat.

19. Sheephead, Rocky-Bancas Association

Well-drained cobbly fine sandy loams and stony loams over mica schist and quartz diorite; 30 to 65 percent slopes

This association is made up of soils that developed in material weathered in place from mica schist and quartz diorite. It occurs in the Mountains. The elevation ranges mainly from 2,000 to 6,000 feet. It is less than 1,000 feet on a small acreage of Bancas soils. The mean annual precipitation is between 18 and 30 inches, and the mean annual air temperature between 56° and 58° F. The frost-free season is about 160 to 230 days. The vegetation consists of chamise, manzanita, scrub oak, ceanothus, California sagebrush, and annual forbs and grasses.

This association occupies about 7 percent of the San Diego Area. Sheephead soils make up about 55 percent of the association, and Bancas about 30 percent. Tollhouse soils, Las Posas soils, La Posta soils, and small areas of rock land make up the remaining 15 percent.

Sheephead soils have a surface layer of dark grayish-brown cobbly fine sandy loam. Below this is fractured mica schist. Rock outcrop covers 2 to 10 percent of the surface. Bancas soils have a surface layer of brown stony loam and a subsoil of yellowish-red clay loam. This is underlain by decomposed granitic rock.

These soils are used for range, watershed, and wildlife habitat.

Group VI. Excessively Drained to Moderately Well Drained, Gently Sloping to Very Steep Sandy Loams to Silt Loams on Uplands in Foothill Areas

The soils in this group are excessively drained to moderately well drained sandy loams to silt loams that have a coarse sandy loam to clay subsoil. They are derived from granitic rock, gabbro, tonalite, metavolcanic rock, and metasedimentary rock. Rock outcrops or stones cover up to 10 percent of the surface in many areas. Slopes range from 2 to 75 percent.

The elevation ranges from 200 to 3,500 feet. The average annual rainfall is between 12 and 20 inches, and the average annual air temperature between 59° and 64° F. The frost-free season is 240 to 340 days. The vegetation consists chiefly of a chaparral-type cover and an understory of annual grasses and shrubs. An oak-savannah type cover grows on the more gentle slopes. Scattered oaks and other tree species grow along drainageways and in areas where water collects.

These soils are used for citrus, irrigated field crops, avocados, range, wildlife habitat, watershed, and recreational areas. Urban use is increasing in some areas.

Seven associations of the San Diego Area are in this group. They make up 30 percent of the Area.

20. Fallbrook-Bonsall Association

Well drained and moderately well drained sandy loams that have a subsoil of sandy clay loam and clay loam over decomposed granodiorite; 2 to 9 percent slopes

This association is made up of soils that developed in material weathered in place from granitic rock. It occurs on uplands and in swales in the Foothills. The elevation ranges from 200 to 2,500 feet. The mean annual precipitation is between 12 and 18 inches, and the mean annual air temperature between 60° and 64° F. The frost-free season is 260 to 340 days. The vegetation consists of annual grasses, oak-savannah, chaparral, and forbs.

This association occupies about 1 percent of the San Diego Area. Fallbrook soils make up about 50 percent of the association, and Bonsall soils about 25 percent. Cienega, Vista, and Visalia soils make up the remaining 25 percent.

Fallbrook soils are well drained. They have a surface layer of brown sandy loam and a subsoil of reddish-brown sandy clay loam. Bonsall soils are moderately well drained. They have a surface layer of brown sandy loam and a subsoil of yellowish-brown heavy clay loam. The underlying decomposed granodiorite is several feet thick.

These soils are used chiefly for citrus, cropland, and range. Urban development is expanding in areas near Ramona.

21. Fallbrook-Vista Association, Rocky

Well-drained sandy loams and coarse sandy loams that have a subsoil of sandy clay loam and sandy loam over decomposed granodiorite; 9 to 30 percent slopes

This association is made up of soils that developed in material weathered from granitic rock. It occurs on uplands in the Foothills. The elevation ranges from 200 to 2,500 feet. The mean annual precipitation is between 14 and 18 inches, and the mean annual air temperature between 60° and 64° F. The frost-free season is 260 to 320 days. The vegetation consists of white and black sage, sumac, flat-top buckwheat, soft chess, wild oats, forbs, and a few California live oaks.

This association occupies about 6 percent of the San Diego Area. Fallbrook soils make up about 45 percent of the association, and Vista soils about 40 percent. Cieneba, Visalia, and Bonsall soils make up the remaining 15 percent.

Fallbrook soils have a surface layer of brown sandy loam and a subsoil of reddish-brown sandy clay loam. Vista soils have a surface layer of dark-brown coarse sandy loam and a subsoil of dark-brown sandy loam. Both soils are underlain by deeply weathered granodiorite. Rock outcrops and boulders cover 2 to 10 percent of this association.

These soils are used chiefly for avocados, citrus, and range. Small areas are used for irrigated pasture and field crops. Urban development is expanding in areas near Escondido, Vista, Rancho Bernardo, and Fallbrook.

22. Las Posas Association, Stony

Well-drained stony fine sandy loams that have a clay subsoil over decomposed gabbro; 9 to 65 percent slopes

This association is made up of soils that developed in material weathered in place from gabbro. It occurs in the Mountains and the Foothills. The elevation ranges from 200 to 3,000 feet. The mean annual precipitation is between 12 and 18 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 240 to 320 days. The vegetation consists mainly of ceanothus, chamise, California sagebrush, and other chaparral species.

This association occupies about 4 percent of the San Diego Area. Las Posas soils make up 80 percent of the association. Cieneba and Fallbrook soils make up the remaining 20 percent.

Las Posas soils have a surface layer of reddish-brown stony fine sandy loam and a subsoil of red light clay. Below this is decomposed gabbro that is many feet thick.

These soils are used mainly for range and watershed. A few areas in the Foothills are used for orchards and cropland.

23. Cieneba-Fallbrook Association, Very Rocky

Excessively drained to well-drained coarse sandy loams and sandy loams that have a sandy clay loam subsoil over decomposed granodiorite; 9 to 75 percent slopes

This association is made up of soils that developed in material weathered in place from decomposed tonalite or granodiorite. It occurs in the Foothills. The elevation ranges from 200 to 3,000 feet. The mean annual precipitation is between 14 and 20 inches, and the mean annual air temperature between 60° and 64° F. The frost-free season is 250 to 320 days. The vegetation consists of chamise, California sagebrush, ceanothus, flat-top buckwheat, and annual grasses and forbs. Scattered oaks grow along drainageways and on some north-facing slopes.

This association represents about 13 percent of the San Diego Area. Cieneba soils make up about 60 percent of the association, and Fallbrook soils about 25 percent. Vista soils, Las Posas soils, and small areas of rock land make up the remaining 15 percent.

Cieneba soils are excessively drained. They have a surface layer of brown coarse sandy loam and are underlain by decomposed granodiorite. Fallbrook soils are well drained. They have a surface layer of brown sandy loam, a subsoil of reddish-brown sandy clay loam, and below this, decomposed granodiorite. Rock outcrops and boulders cover 2 to 25 percent of the surface.

These soils are used mainly for range and watershed. Selected areas of deeper soils that are free of rock outcrop are used for orchards.

24. Exchequer, Rocky-Blasingame Association

Well-drained silt loams and stony loams over metavolcanic rock; 30 to 75 percent slopes

This association is made up of soils that developed in material weathered in place from metavolcanic rock. It occurs in the Foothills. The elevation ranges from 400 to 3,000 feet. The mean annual precipitation is between 14 and 20 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 240 to 280 days. The vegetation is predominantly chaparral; there are a few oaks along the drainageways.

This association occupies about 1 percent of the San Diego Area. Exchequer soils make up about 60 percent of the association, and Blasingame soils about 30 percent. The Friant and Cieneba soils make up the remaining 10 percent.

Exchequer soils have a surface layer of yellowish-red silt loam and are underlain by whitish and greenish, hard metavolcanic rock. Rock outcrop covers 2 to 10 percent of the surface. Blasingame soils have a surface layer of brown stony loam and

loam, a subsoil of reddish-brown stony clay loam, and below this, weathered metavolcanic rock.

These soils are used chiefly for range, watershed, and wildlife habitat.

25. Exchequer-San Miguel Association, Rocky

Well-drained silt loams over metavolcanic rock; 30 to 75 percent slopes

This association is made up of soils that developed in hard metavolcanic rock. It occurs in the Foothills. The elevation ranges from 400 to 3,300 feet. The mean annual precipitation is between 13 and 20 inches, and the mean annual air temperature between 59° and 62° F. The frost-free season is 240 to 280 days. The vegetation is mainly chaparral, consisting of chamise, ceanothus, flattop buckwheat, and California sagebrush.

This association occupies about 2 percent of the San Diego Area. Exchequer soils make up about 45 percent of the association, and San Miguel soils about 45 percent. Cienega soils, Friant soils, and rock land make up the remaining 10 percent.

Exchequer soils have a surface layer of yellowish-red silt loam and are underlain by hard metavolcanic rock. San Miguel soils have a surface layer of light yellowish-brown silt loam, a subsoil of strong-brown clay, and below this, hard metavolcanic rock. Rock outcrop covers 2 to 10 percent of the surface.

These soils are used for range and watershed.

26. Friant-Escondido Association, Eroded

Well-drained fine sandy loams and very fine sandy loams over metasedimentary rock; 30 to 70 percent slopes

This association is made up of soils that developed in material weathered from relatively hard metasedimentary rock. It occurs in the Foothills. The elevation ranges from 400 to 3,500 feet. The mean annual precipitation is between 12 and 20 inches, and the mean annual air temperature between 59° and 62° F. The frost-free season is 240 to 310 days. The vegetation consists of California sagebrush, flattop buckwheat, white sage, a few scattered oaks, and annual grasses and forbs.

This association occupies 3 percent of the San Diego Area. Friant soils make up about 65 percent of the association, and Escondido soils about 20 percent. Cienega soils, Exchequer soils, Fallbrook soils, and small areas of rock land make up the remaining 15 percent.

Friant soils have a surface layer of brown fine sandy loam. Below this is gray, hard, fine-grained metasedimentary rock. Escondido soils have a surface layer of dark-brown very fine sandy loam, a

subsoil of brown very fine sandy loam, and below this, hard metasedimentary rock.

These soils are used mainly for range and watershed. Small selected areas of the deeper soils are used for citrus orchards and field crops.

Group VII. Well Drained and Moderately Well Drained, Moderately Sloping to Very Steep Loamy Fine Sands to Clays on Uplands in Coastal Plain Areas

The soils in this group are well drained and moderately well drained loamy fine sands to clays. They formed in material derived from marine sandstone and shale and breccia. In some places the soils that have a surface layer of loamy fine sand and loam have a sandy clay and clay subsoil. Slopes range from 5 to 75 percent.

The elevation ranges from near sea level to 1,800 feet. The average annual rainfall is between 10 and 16 inches, and the average annual air temperature between 60° and 62° F. The frost-free season is 280 to 350 days. The vegetation consists of annual grasses and forbs and scattered shrubs. Shrubs are predominant in areas of shallow or eroded soils.

These soils are used for truck crops, citrus, dryfarmed grain, range, watershed, and wildlife habitat. Urban and industrial uses are increasing.

Five associations of the San Diego Area are in this group. They represent 8 percent of the Area.

27. Diablo-Altamont Association

Well-drained clays; 5 to 15 percent slopes

This association is made up of soils that developed in material derived from soft marine sandstone and shale. It occupies rolling uplands on the Coastal Plains. The elevation ranges from 100 to 600 feet. The mean annual precipitation is between 10 and 14 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 300 to 340 days. The winter growing season has only light frost. The vegetation consists of annual grasses and forbs and small thickets of brush.

This association occupies about 1 percent of the San Diego Area. Diablo soils make up 45 percent of the association, and Altamont soils 45 percent. Linne and Olivenhain soils make up the remaining 10 percent.

Diablo soils are dark-gray clays. Altamont soils are dark-brown clays. These soils overlie light yellowish-brown or light-gray marine sandstone and shale that range from noncalcareous to strongly calcareous.

These soils are used mostly for truck crops, range, and housing developments. A few small areas are used for dryfarmed barley. The occasional light frosts cause very little damage to winter vegetables. Urban and industrial uses are increasing in the southwestern part of the county.

28. Diablo-Linne Association

Well-drained clays and clay loams; 15 to 50 percent slopes

This association is made up of soils that developed in material derived from soft calcareous marine sandstone and shale. It occurs on uplands on the Coastal Plains. The elevation ranges from 100 to 600 feet. The mean annual precipitation is between 12 and 14 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 280 to 340 days. The vegetation consists of annual grasses and forbs, flattop buckwheat, California sagebrush, sugarbush, and scrub oak.

This association occupies about 1 percent of the San Diego Area. Diablo soils make up about 50 percent of the association, and Linne soils about 40 percent. Salinas and Olivenhain soils make up most of the remaining 10 percent.

Diablo soils are dark-gray clays. Linne soils are gray clay loams. These soils overlie light-gray to white, calcareous shale and sandstone. In many places the surface layer is moderately to strongly calcareous.

These soils are used mostly for range. A few areas are used for dryfarmed grain and irrigated tomatoes. Urban development is increasing in areas southeast of the city of San Diego.

29. Diablo-Las Flores Association

Well drained clays and moderately well drained loamy fine sands that have a subsoil of sandy clay; 9 to 30 percent slopes

This association is made up of soils that developed in material derived from calcareous and noncalcareous marine sandstone and shale. It occurs on the Coastal Plains. The elevation ranges from 100 to 600 feet. The mean annual precipitation is between 10 and 14 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 300 to 340 days. The vegetation consists of soft chess, ripgut brome, anise, tarweed, and Australian saltbush.

This association occupies about 2 percent of the San Diego Area. Diablo soils make up about 45 percent of the association, and Las Flores soils about 45 percent. Gaviota, Huerhuero, Linne, and Olivenhain soils make up the remaining 10 percent.

Diablo soils are well-drained, dark-gray clays. Las Flores soils are moderately well drained and have a surface layer of light brownish-gray loamy fine sand and a subsoil of grayish-brown sandy clay. These soils overlie light-gray, soft marine sandstone and shale.

These soils are used mostly for range. A few small areas are used for citrus and truck crops. Winter vegetables can be grown in areas of good air drainage.

30. Las Flores-Huerhuero Association, Eroded

Moderately well drained loamy fine sands to loams that have a subsoil of sandy clay or clay; 9 to 30 percent slopes

This association is made up of soils that developed in material derived from sandstone or marine sediments. It occurs on uplands on the Coastal Plains. The elevation ranges from sea level to about 500 feet. The mean annual precipitation is between 10 and 13 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 300 to 350 days. The vegetation consists of brush, forbs, and annual grasses.

This association occupies about 2 percent of the San Diego Area. Las Flores soils make up about 45 percent of the association, and Huerhuero soils about 40 percent. Diablo soils, Linne soils, Olivenhain soils, and Terrace escarpments make up the remaining 15 percent.

Las Flores soils have a surface layer of light brownish-gray loamy fine sand and a subsoil of grayish-brown sandy clay. Huerhuero soils have a surface layer of brown loam and a subsoil of brown clay. Las Flores soils overlie soft sandstone and shaly marine sediments, and Huerhuero soils, yellowish-brown loamy sand.

These soils are used mostly for range. A limited acreage is used for irrigated truck crops. Urban and industrial uses are increasing.

31. Gaviota-Hambright Association, Eroded

Well-drained fine sandy loams and gravelly clay loams over sandstone and breccia; 30 to 75 percent slopes

This association is made up of soils that developed in material derived from soft marine sandstone and breccia. It occurs on the Coastal Plains. The elevation ranges from 200 to 1,800 feet. The mean annual precipitation is between 10 and 16 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 280 to 330 days. The vegetation includes chamise, scrub oak, cactus, buckwheat, and annual forbs and grasses.

This association occupies about 2 percent of the San Diego Area. Gaviota soils make up about 45 percent of the association, and Hambright about 35 percent. Linne soils, Huerhuero soils, and Rough broken land make up the remaining 20 percent.

Gaviota soils have a surface layer of yellowish-brown fine sandy loam. Below this is semiconsolidated sandstone. Hambright soils have a surface layer of brown gravelly clay loam and a subsoil of brown gravelly heavy clay loam. They are underlain by shaly breccia.

Part of the acreage is a military reservation. The rest is used mostly for range and watershed. There is little urban development.

Group VIII. Miscellaneous Land Types of the Desert, Mountains, Foothills, and Coastal Plains

The miscellaneous land types in this group vary considerably in soil characteristics and qualities. They are used only for wildlife habitat, watershed, and recreational areas.

Three associations in the San Diego Area are in this group. They represent about 12 percent of the Area.

32. Rough Broken Land-Terrace Escarpments-Sloping Gullied Land Association

Steep and very steep dissected land, escarpments, and gullied land

This association is made up of areas that are of no value for farming and ranching. It occurs in the Desert, in the Mountains, in the Foothills, and on the Coastal Plains. Some of these areas are almost barren; some have a moderate cover of chaparral.

This association occupies about 2 percent of the San Diego Area. Rough broken land makes up about 45 percent of the association, Terrace escarpments about 25 percent, and Sloping gullied land about 15 percent. Tollhouse, Sheephead, Cieneba, and Ham-bright soils make up the remaining 15 percent.

Rough broken land is deeply dissected by narrow V-shaped valleys and sharp tortuous divides. Many areas are barren and are rapidly eroding. The vegetated areas have a thin mantle of soil. This land type formed mainly over gravelly to loamy sediments. A few areas overlie weak sandstone and shale.

Terrace escarpments occur as steep to very steep, relatively even fronts of terraces and coastal plains. They also occur as irregular areas between narrow alluvial terraces and the adjoining smooth uplands. The underlying material consists of recent sediments or soft marine sandstone and shale.

Sloping gullied land consists of relatively barren areas that are dissected by numerous actively eroding gullies or by single deeply entrenched gullies that have very steep sides. In many places

the gullies are eroding into the soft sandstone, shale, and decomposed granite.

These miscellaneous land types are used mainly for watershed.

33. Badland Association

Dominantly barren eroded shales

This association is made up of moderately sloping to steep, essentially barren areas that are dissected by few to numerous intermittent drainage-ways. It occurs in the Desert. It is underlain by shale, soft sandstone, and silty, sandy, and gravelly sediments. Runoff is very rapid, and erosion is very active. Sediment yield is very high.

This association occupies less than 1 percent of the San Diego Area.

Badland makes up about 65 percent of this association. Acid igneous rock land, Rough broken land, and sand dunes make up the remaining 35 percent.

Badland is of no value for farming or ranching and of very little value for wildlife habitat or watershed.

34. Rock Land Association

Dominantly exposed bedrock and very large boulders

This association is 50 to 90 percent exposed bedrock and very large boulders. It occurs in the Desert, in the Mountains, and in the Foothills. The outcrops and boulders are chiefly granodiorite, quartz diorite, gabbro, mica schist, metavolcanic rock, and metasedimentary rock. A thin mantle of soil occurs in pockets between the rock outcrops.

This association occupies more than 8 percent of the San Diego Area. Acid igneous rock land makes up 75 percent of the association. Metamorphic rock land and other rocky soils make up the remaining 25 percent.

Rock land has no value for farming or ranching. It is used mainly for watershed and wildlife habitat.

DESCRIPTIONS OF THE SOILS

This section provides for those who want detailed information about the soils of the San Diego Area. It describes each series and the mapping units in each series. The approximate acreage and the proportionate extent of each soil are given in table 2.

The description of a soil series mentions features that apply to all of the soils in that series. Unless otherwise stated, the profile described for the series is considered representative of all the soils in the series. Differences among the soils of one series are pointed out in the descriptions of the individual soils.

Soil profiles are described by layers, or soil horizons, to which soil scientists assign a symbol, for example, A1. The symbol has a special meaning for soil scientists and others who make detailed studies of the soils. Most readers need to remember only that "A" designates the surface layer, "B" the subsoil, "C" the substratum or parent material, and "R" bedrock. All measurements shown in the soil profiles indicate the depth from the surface.

The color of each horizon is described in words, such as yellowish brown, and is also indicated by a symbol that indicates hue, value, and chroma, for example, 10YR 5/4. Such symbols, which are Munsell color notations (10), are used by soil scientists to precisely evaluate the color of the soil. Unless otherwise noted, the colors mentioned are for dry soils.

The texture of the soil refers to the content of sand, silt, and clay (10). Texture is determined by the way the soil feels when it is rubbed between the fingers, and it is checked by laboratory analysis. Each mapping unit is identified by a textural class name, for example, sandy loam. This name refers to the texture of the surface layer, or the A horizon.

The structure of the soil indicates the arrangement of individual soil particles into larger grains, or aggregates, and the amount of pore space between the grains. Structure is described in terms that denote the strength or grade, the size, and the shape of the aggregates. For example, a layer may consist of soil material that has weak, fine, blocky structure.

Boundaries between the horizons are described according to thickness and shape. The thickness is described as abrupt, clear, gradual, or diffuse, and the shape as smooth, wavy, irregular, or broken.

Other terms used in the soil descriptions and other parts of the survey are defined in the Glossary.

Acid Igneous Rock Land

Acid igneous rock land (AcG) is rough broken terrain. The topography ranges from low hills to very steep mountains. Large boulders and rock outcrops of granite, granodiorite, tonalite, quartz diorite, gabbro, basalt, or gabbro diorite cover 50 to 90 percent of the total area. The soil material is loam

to loamy coarse sand in texture and is very shallow over decomposed granite or basic igneous rock. In a few places there are pockets of deep soil between the rocks.

The vegetation varies according to the elevation and the climate. In the foothills, the vegetation is mainly a sparse cover of sumac, sugarbush, chamise, and ceanothus. In the mountains, chamise, manzanita, red shank, ceanothus, and oak brush are the common species. In the desert, a very sparse cover of desert shrubs, cactus, and grasses is typical. Approximately 7,200 acres in the desert is 90 percent exposed, rounded granitic rock. Many areas in the desert are practically barren and have very rapid runoff.

Acid igneous rock land is of no value for farming. It can be used for wildlife habitat and watershed. Capability unit VIIIs-1 (19, 20, 30).

Altamont Series

The Altamont series consists of well-drained clays that formed in material weathered from calcareous shale. These soils are on uplands and have slopes of 5 to 50 percent. The elevation ranges from 200 to 600 feet. The mean annual precipitation is between 10 and 14 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 300 to 340 days. The winter growing season has only light frost. The vegetation in uncultivated areas is mainly annual grasses and scattered shrubs.

In a representative profile the surface layer is dark-brown, neutral to moderately alkaline clay about 28 inches thick. The next layer is dark-brown and light olive-brown, moderately alkaline heavy clay loam about 8 inches thick. Below this is soft calcareous shale.

Altamont soils are used for range and irrigated tomatoes.

Altamont clay, 15 to 30 percent slopes (AtE).-- This moderately steep soil is on rounded hills. The slope averages 17 percent.

Representative profile: 4 miles north of Soledad Canyon Road, NE 1/4 of SW 1/4 sec. 4, T. 15 S., R. 3 W.

Ap--0 to 4 inches, dark-brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; uppermost 1/4 to 1/2 inch pale brown (10YR 6/3), brown (10YR 5/3) moist; strong, coarse, prismatic and strong, coarse, subangular blocky structure; very hard, firm, sticky, plastic; common micro and very fine roots between peds; many very fine tubular and interstitial pores; neutral (pH 6.6); clear, smooth boundary.

All--4 to 18 inches, dark-brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; strong, coarse, prismatic and strong, coarse, angular blocky structure; extremely hard, very firm, very

TABLE 2.--APPROXIMATE ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Soil	Area	Extent	Soil	Area	Extent
	Acres	Percent		Acres	Percent
Acid igneous rock land-----	142,126	6.6	Bosanko clay, 15 to 30 percent slopes-----	397	(1/)
Altamont clay, 5 to 9 percent slopes-----	2,006	(1/)	Bosanko stony clay, 5 to 9 percent slopes-----	681	(1/)
Altamont clay, 9 to 15 percent slopes-----	2,071	(1/)	Bull Trail sandy loam, 2 to 5 percent slopes-----	4,456	.2
Altamont clay, 9 to 15 percent slopes, eroded-----	523	(1/)	Bull Trail sandy loam, 5 to 9 percent slopes-----	4,033	.1
Altamont clay, 15 to 30 percent slopes-----	2,451	.1	Bull Trail sandy loam, 9 to 15 percent slopes, eroded-----	4,639	.2
Altamont clay, 15 to 30 percent slopes, eroded-----	1,055	(1/)	Bull Trail sandy loam, 15 to 30 percent slopes, eroded-----	3,219	.1
Altamont clay, 30 to 50 percent slopes-----	4,450	.2	Calpine coarse sandy loam, 2 to 5 percent slopes-----	1,538	(1/)
Anderson very gravelly sandy loam, 5 to 9 percent slopes-----	1,244	(1/)	Calpine coarse sandy loam, 5 to 9 percent slopes-----	5,988	.2
Anderson very gravelly sandy loam, 9 to 45 percent slopes-----	1,563	(1/)	Calpine coarse sandy loam, 5 to 9 percent slopes, eroded-----	2,664	.1
Arlington coarse sandy loam, 2 to 9 percent slopes-----	932	(1/)	Calpine coarse sandy loam, 9 to 15 percent slopes, eroded-----	3,044	.1
Auld clay, 5 to 9 percent slopes-----	910	(1/)	Carlsbad gravelly loamy sand, 2 to 5 percent slopes-----	1,668	(1/)
Auld clay, 9 to 15 percent slopes-----	754	(1/)	Carlsbad gravelly loamy sand, 5 to 9 percent slopes-----	2,485	.1
Auld stony clay, 9 to 30 percent slopes-----	1,402	(1/)	Carlsbad gravelly loamy sand, 9 to 15 percent slopes-----	840	(1/)
Badland-----	2,698	.1	Carlsbad gravelly loamy sand, 15 to 30 percent slopes-----	402	(1/)
Bancas stony loam, 5 to 30 percent slopes-----	5,439	.2	Carlsbad-Urban land complex, 2 to 9 percent slopes-----	1,485	(1/)
Bancas stony loam, 5 to 30 percent slopes, eroded-----	4,450	.2	Carlsbad-Urban land complex, 9 to 30 percent slopes-----	600	(1/)
Bancas stony loam, 30 to 65 percent slopes-----	24,498	1.1	Carrizo very gravelly sand, 0 to 9 percent slopes-----	26,160	1.2
Bancas stony loam, 30 to 65 percent slopes, eroded-----	8,070	.3	Chesterton fine sandy loam, 2 to 5 percent slopes-----	4,487	.2
Blasingame loam, 9 to 30 percent slopes-----	1,065	(1/)	Chesterton fine sandy loam, 5 to 9 percent slopes-----	2,222	.1
Blasingame stony loam, 9 to 30 percent slopes-----	856	(1/)	Chesterton fine sandy loam, 9 to 15 percent slopes, eroded-----	708	(1/)
Blasingame stony loam, 30 to 50 percent slopes-----	3,007	.1	Chesterton-Urban land complex, 2 to 9 percent slopes-----	6,807	.3
Bonsall sandy loam, 2 to 9 percent slopes-----	2,058	(1/)	Chino fine sandy loam, 0 to 2 percent slopes-----	3,586	.1
Bonsall sandy loam, 2 to 9 percent slopes, eroded-----	1,837	(1/)	Chino fine sandy loam, 2 to 5 percent slopes-----	675	(1/)
Bonsall sandy loam, 9 to 15 percent slopes, eroded-----	1,456	(1/)	Chino silt loam, saline, 0 to 2 percent slopes-----	5,232	.2
Bonsall sandy loam, thick surface, 2 to 9 percent slopes-----	1,172	(1/)	Cieneba coarse sandy loam, 5 to 15 percent slopes, eroded-----	4,374	.1
Bonsall-Fallbrook sandy loams, 2 to 5 percent slopes-----	2,632	.1	Cieneba coarse sandy loam, 15 to 30 percent slopes, eroded-----	8,886	.4
Boomer loam, 2 to 9 percent slopes-----	558	(1/)	Cieneba coarse sandy loam, 30 to 65 percent slopes, eroded-----	12,752	.5
Boomer loam, 9 to 30 percent slopes-----	1,651	(1/)	Cieneba rocky coarse sandy loam, 9 to 30 percent slopes, eroded-----	32,227	1.4
Boomer stony loam, 9 to 30 percent slopes-----	9,270	.4	Cieneba very rocky coarse sandy loam, 30 to 75 percent slopes-----	112,088	5.2
Boomer stony loam, 30 to 65 percent slopes-----	11,867	.5			
Bosanko clay, 2 to 9 percent slopes-----	943	(1/)			
Bosanko clay, 9 to 15 percent slopes-----	577	(1/)			

TABLE 2.--APPROXIMATE ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Soil	Area		Soil	Area	
	Acres	Percent		Acres	Percent
Cieneba-Fallbrook rocky sandy loams, 9 to 30 percent slopes, eroded-----	20,222	0.9	Fallbrook sandy loam, 9 to 15 percent slopes, eroded-----	34,944	1.5
Cieneba-Fallbrook rocky sandy loams, 30 to 65 percent slopes, eroded-----	101,179	4.5	Fallbrook sandy loam, 15 to 30 percent slopes, eroded-----	24,106	1.0
Clayey alluvial land-----	1,276	(1/)	Fallbrook sandy loam, 9 to 30 percent slopes, severely eroded-----	2,459	.1
Coastal beaches-----	1,912	(1/)	Fallbrook rocky sandy loam, 5 to 9 percent slopes-----	1,589	(1/)
Corralitos loamy sand, 0 to 5 percent slopes-----	1,420	(1/)	Fallbrook rocky sandy loam, 9 to 30 percent slopes-----	8,702	.3
Corralitos loamy sand, 5 to 9 percent slopes-----	1,655	.1	Fallbrook rocky sandy loam, 9 to 30 percent slopes, eroded-----	11,960	.5
Corralitos loamy sand, 9 to 15 percent slopes-----	1,894	(1/)	Fallbrook-Vista sandy loams, 9 to 15 percent slopes-----	6,858	.3
Crouch coarse sandy loam, 5 to 30 percent slopes-----	15,736	.7	Fallbrook-Vista sandy loams, 15 to 30 percent slopes-----	8,444	.3
Crouch coarse sandy loam, 30 to 50 percent slopes-----	10,416	.4	Friant fine sandy loam, 30 to 50 percent slopes-----	3,176	.1
Crouch rocky coarse sandy loam, 5 to 30 percent slopes-----	13,052	.5	Friant rocky fine sandy loam, 9 to 30 percent slopes-----	9,014	.4
Crouch rocky coarse sandy loam, 30 to 70 percent slopes-----	27,751	1.2	Friant rocky fine sandy loam, 30 to 70 percent slopes-----	31,059	1.4
Crouch stony fine sandy loam, 30 to 75 percent slopes-----	5,806	.2	Gaviota fine sandy loam, 9 to 30 percent slopes-----	2,593	.1
Diablo clay, 2 to 9 percent slopes-----	9,620	.4	Gaviota fine sandy loam, 30 to 50 percent slopes-----	15,230	.6
Diablo clay, 9 to 15 percent slopes-----	11,338	.5	Grangeville fine sandy loam, 0 to 2 percent slopes-----	3,610	.1
Diablo clay, 15 to 30 percent slopes-----	7,929	.3	Greenfield sandy loam, 0 to 2 percent slopes-----	906	(1/)
Diablo clay, 15 to 30 percent slopes, eroded-----	2,598	.1	Greenfield sandy loam, 2 to 5 percent slopes-----	3,537	.1
Diablo clay, 30 to 50 percent slopes-----	2,565	.1	Greenfield sandy loam, 5 to 9 percent slopes-----	2,964	.1
Diablo-Urban land complex, 5 to 15 percent slopes-----	4,498	.2	Greenfield sandy loam, 9 to 15 percent slopes-----	1,240	(1/)
Diablo-Urban land complex, 15 to 50 percent slopes-----	1,794	(1/)	Hambright gravelly clay loam, 30 to 75 percent slopes-----	11,250	.5
Diablo-Olivenhain complex, 9 to 30 percent slopes-----	5,091	.2	Holland fine sandy loam, 5 to 15 percent slopes-----	7,511	.3
Elder shaly fine sandy loam, 2 to 9 percent slopes-----	1,243	(1/)	Holland fine sandy loam, 15 to 30 percent slopes-----	3,439	.1
Escondido very fine sandy loam, 5 to 9 percent slopes-----	1,813	(1/)	Holland stony fine sandy loam, 5 to 30 percent slopes-----	19,715	.8
Escondido very fine sandy loam, 9 to 15 percent slopes, eroded-----	4,160	.1	Holland stony fine sandy loam, 30 to 60 percent slopes-----	13,137	.5
Escondido very fine sandy loam, 15 to 30 percent slopes, eroded-----	5,050	.2	Holland fine sandy loam, deep, 2 to 9 percent slopes-----	3,529	.1
Escondido very fine sandy loam, deep, 5 to 9 percent slopes-----	628	(1/)	Huerhuero loam, 2 to 9 percent slopes-----	15,650	.7
Exchequer rocky silt loam, 9 to 30 percent slopes-----	2,228	.1	Huerhuero loam, 5 to 9 percent slopes, eroded-----	3,640	.1
Exchequer rocky silt loam, 30 to 70 percent slopes-----	7,462	.3	Huerhuero loam, 9 to 15 percent slopes-----	2,615	.1
Fallbrook sandy loam, 2 to 5 percent slopes-----	1,262	(1/)	Huerhuero loam, 9 to 15 percent slopes, eroded-----	2,845	.1
Fallbrook sandy loam, 5 to 9 percent slopes-----	7,217	.3	Huerhuero loam, 15 to 30 percent slopes, eroded-----	6,968	.3
Fallbrook sandy loam, 5 to 9 percent slopes, eroded-----	8,003	.3			

TABLE 2.--APPROXIMATE ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Soil	Area	Extent	Soil	Area	Extent
	<u>Acres</u>	<u>Percent</u>		<u>Acres</u>	<u>Percent</u>
Huerhuero-Urban land complex, 2 to 9 percent slopes-----	13,509	0.6	Las Posas fine sandy loam, 15 to 30 percent slopes, eroded-----	4,617	0.2
Huerhuero-Urban land complex, 9 to 30 percent slopes-----	3,341	.1	Las Posas stony fine sandy loam, 9 to 30 percent slopes-----	11,546	.5
Indio silt loam, 0 to 2 percent slopes-----	1,771	(1/)	Las Posas stony fine sandy loam, 9 to 30 percent slopes, eroded-----	4,421	.2
Indio silt loam, 2 to 5 percent slopes-----	247	(1/)	Las Posas stony fine sandy loam, 30 to 65 percent slopes-----	53,241	2.4
Indio silt loam, saline, 0 to 2 percent slopes-----	6,645	.3	Linne clay loam, 9 to 30 percent slopes-----	3,779	.1
Indio silt loam, dark variant----	1,037	(1/)	Linne clay loam, 30 to 50 percent slopes-----	6,173	.2
Kitchen Creek loamy coarse sand, 5 to 9 percent slopes-----	5,123	.2	Loamy alluvial land-----	10,430	.4
Kitchen Creek loamy coarse sand, 9 to 15 percent slopes, eroded-----	2,039	(1/)	Loamy alluvial land-Huerhuero complex, 9 to 50 percent slopes, severely eroded-----	6,169	.2
La Posta loamy coarse sand, 5 to 30 percent slopes, eroded-----	29,354	1.3	Made land-----	5,928	.2
La Posta loamy coarse sand, 5 to 30 percent slopes, severely eroded-----	4,329	.1	Marina loamy coarse sand, 2 to 9 percent slopes-----	13,538	.6
La Posta rocky loamy coarse sand, 5 to 30 percent slopes-----	23,061	1.0	Marina loamy coarse sand, 9 to 30 percent slopes-----	2,105	(1/)
La Posta rocky loamy coarse sand, 5 to 30 percent slopes, eroded-----	31,744	1.4	Mecca coarse sandy loam, 0 to 2 percent slopes-----	2,268	.1
La Posta rocky loamy coarse sand, 30 to 50 percent slopes, eroded-----	7,270	.3	Mecca coarse sandy loam, 2 to 5 percent slopes-----	4,679	.2
La Posta-Sheephead complex, 9 to 30 percent slopes-----	2,890	.1	Mecca fine sandy loam, 0 to 2 percent slopes, eroded-----	3,867	.1
La Posta-Sheephead complex, 30 to 65 percent slopes-----	4,112	.1	Mecca sandy loam, saline, 0 to 2 percent slopes-----	1,180	(1/)
Las Flores loamy fine sand, 2 to 9 percent slopes-----	5,440	.2	Metamorphic rock land-----	27,337	1.2
Las Flores loamy fine sand, 5 to 9 percent slopes, eroded-----	4,162	.1	Mottsville loamy coarse sand, 0 to 2 percent slopes-----	1,587	(1/)
Las Flores loamy fine sand, 9 to 15 percent slopes-----	2,693	.1	Mottsville loamy coarse sand, 2 to 9 percent slopes-----	32,030	1.4
Las Flores loamy fine sand, 9 to 15 percent slopes, eroded-----	4,941	.2	Mottsville loamy coarse sand, 9 to 15 percent slopes-----	8,412	.3
Las Flores loamy fine sand, 15 to 30 percent slopes-----	4,203	.1	Mottsville loamy coarse sand, wet, 0 to 2 percent slopes-----	4,355	.1
Las Flores loamy fine sand, 15 to 30 percent slopes, eroded-----	3,625	.1	Olivenhain cobbly loam, 2 to 9 percent slopes-----	6,606	.3
Las Flores loamy fine sand, 9 to 30 percent slopes, severely eroded-----	2,846	.1	Olivenhain cobbly loam, 9 to 30 percent slopes-----	14,225	.6
Las Flores-Urban land complex, 2 to 9 percent slopes-----	1,907	(1/)	Olivenhain cobbly loam, 30 to 50 percent slopes-----	13,779	.6
Las Flores-Urban land complex, 9 to 30 percent slopes-----	630	(1/)	Olivenhain-Urban land complex, 2 to 9 percent slopes-----	2,657	.1
Las Posas fine sandy loam, 2 to 5 percent slopes-----	353	(1/)	Olivenhain-Urban land complex, 9 to 30 percent slopes-----	2,189	(1/)
Las Posas fine sandy loam, 5 to 9 percent slopes-----	983	(1/)	Placentia sandy loam, 0 to 2 percent slopes-----	559	(1/)
Las Posas fine sandy loam, 5 to 9 percent slopes, eroded-----	1,088	(1/)	Placentia sandy loam, 2 to 9 percent slopes-----	10,193	.4
Las Posas fine sandy loam, 9 to 15 percent slopes, eroded-----	5,634	.2	Placentia sandy loam, 5 to 9 percent slopes, eroded-----	2,519	.1
			Placentia sandy loam, 9 to 15 percent slopes, eroded-----	1,886	(1/)
			Placentia sandy loam, thick surface, 0 to 2 percent slopes----	1,030	(1/)

TABLE 2.--APPROXIMATE ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Soil	Area		Soil	Area	
	Acres	Percent		Acres	Percent
Placentia sandy loam, thick surface, 2 to 9 percent slopes----	14,301	0.6	San Miguel-Exchequer rocky silt loams, 9 to 70 percent slopes----	42,291	1.9
Playas-----	2,422	.1	Sheephead rocky fine sandy loam, 9 to 30 percent slopes, eroded-----	18,715	.8
Ramona sandy loam, 0 to 2 percent slopes-----	1,078	(1/)	Sheephead rocky fine sandy loam, 30 to 65 percent slopes, eroded-----	80,814	3.6
Ramona sandy loam, 2 to 5 percent slopes-----	5,961	.2	Sloping gullied land-----	23,942	1.0
Ramona sandy loam, 5 to 9 percent slopes-----	5,906	.2	Soboba stony loamy sand, 9 to 30 percent slopes-----	5,867	.2
Ramona sandy loam, 5 to 9 percent slopes, eroded-----	3,283	.1	Steep gullied land-----	6,254	.2
Ramona sandy loam, 9 to 15 percent slopes, eroded-----	4,214	.1	Stockpen gravelly clay loam, 0 to 2 percent slopes-----	2,965	.1
Ramona gravelly sandy loam, 9 to 15 percent slopes-----	3,174	.1	Stockpen gravelly clay loam, 2 to 5 percent slopes-----	1,809	(1/)
Ramona gravelly sandy loam, 15 to 30 percent slopes-----	1,602	(1/)	Stony land-----	7,906	.3
Redding gravelly loam, 2 to 9 percent slopes-----	18,456	.8	Terrace escarpments-----	18,910	.8
Redding cobbly loam, 9 to 30 percent slopes-----	5,389	.2	Tidal flats-----	3,428	.1
Redding cobbly loam, dissected, 15 to 50 percent slopes-----	26,341	1.1	Tollhouse rocky coarse sandy loam, 5 to 30 percent slopes, eroded-----	34,484	1.5
Redding-Urban land complex, 2 to 9 percent slopes-----	9,249	.4	Tollhouse rocky coarse sandy loam, 30 to 65 percent slopes-----	88,779	4.0
Redding-Urban land complex, 9 to 30 percent slopes-----	2,559	.1	Tujunga sand, 0 to 5 percent slopes-----	19,291	.8
Reiff fine sandy loam, 0 to 2 percent slopes-----	1,949	(1/)	Urban land-----	19,611	.8
Reiff fine sandy loam, 2 to 5 percent slopes-----	1,650	(1/)	Visalia sandy loam, 0 to 2 percent slopes-----	15,078	.6
Reiff fine sandy loam, 5 to 9 percent slopes-----	2,105	(1/)	Visalia sandy loam, 2 to 5 percent slopes-----	17,274	.7
Riverwash-----	19,699	.8	Visalia sandy loam, 5 to 9 percent slopes-----	6,156	.2
Rositas fine sand, 0 to 2 percent slopes-----	12,923	.5	Visalia sandy loam, 9 to 15 percent slopes-----	1,655	(1/)
Rositas fine sand, hummocky, 5 to 9 percent slopes-----	1,708	(1/)	Visalia gravelly sandy loam, 2 to 5 percent slopes-----	1,993	(1/)
Rositas loamy coarse sand, 0 to 2 percent slopes-----	5,450	.2	Visalia gravelly sandy loam, 5 to 9 percent slopes-----	558	(1/)
Rositas loamy coarse sand, 2 to 9 percent slopes-----	21,790	.9	Vista coarse sandy loam, 5 to 9 percent slopes-----	4,393	.1
Rositas loamy coarse sand, 9 to 15 percent slopes-----	2,155	(1/)	Vista coarse sandy loam, 9 to 15 percent slopes-----	4,997	.2
Rough broken land-----	19,046	.8	Vista coarse sandy loam, 9 to 15 percent slopes, eroded-----	4,012	.1
Salinas clay loam, 0 to 2 percent slopes-----	2,199	(1/)	Vista coarse sandy loam, 15 to 30 percent slopes-----	12,357	.5
Salinas clay loam, 2 to 9 percent slopes-----	7,480	.3	Vista coarse sandy loam, 15 to 30 percent slopes, eroded-----	5,287	.2
Salinas clay, 0 to 2 percent slopes-----	2,020	(1/)	Vista coarse sandy loam, 30 to 65 percent slopes-----	5,841	.2
Salinas clay, 2 to 5 percent slopes-----	1,105	(1/)	Vista rocky coarse sandy loam, 5 to 15 percent slopes-----	7,234	.3
San Miguel rocky silt loam, 9 to 30 percent slopes-----	3,991	.1	Vista rocky coarse sandy loam, 15 to 30 percent slopes-----	7,204	.3

TABLE 2.--APPROXIMATE ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Soil	Area	Extent	Soil	Area	Extent
	<u>Acres</u>	<u>Percent</u>		<u>Acres</u>	<u>Percent</u>
Vista rocky coarse sandy loam, 30 to 65 percent slopes-----	8,176	0.3	Gravel pits-----	2,048	(1/)
Wyman loam, 2 to 5 percent slopes--	1,508	(1/)	Lakes and lagoons-----	17,965	.8
Wyman loam, 5 to 9 percent slopes--	2,391	.1	Salt ponds-----	1,353	(1/)
Wyman loam, 9 to 15 percent slopes-----	405	(1/)	Total-----	2,204,880	88.2

1/

Less than 0.1 percent. Items in this category total 11.8 percent of the area surveyed.

sticky, very plastic; common micro and very fine roots flattened or compressed; common very fine tubular pores; neutral (pH 7.2); many slickensides; clear, smooth boundary.

A12--18 to 28 inches, dark-brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; moderate, coarse, prismatic and moderate, coarse, angular blocky structure; extremely hard, very firm, very sticky, very plastic; common micro and very fine roots; few very fine tubular pores; few segregated lime nodules; slightly effervescent, moderately alkaline (pH 8.0); many slickensides; gradual, wavy boundary.

ACca--28 to 36 inches, dark-brown (10YR 4/3) and light olive-brown (2.5Y 5/4) heavy clay loam, brown (10YR 3/3) and light yellowish brown (2.5Y 6/4) moist; moderate, coarse, prismatic and moderate, coarse, angular blocky structure; very hard, firm, sticky, plastic; few micro and very fine roots; few very fine tubular pores; moderately alkaline (pH 8.0); fine lime nodules and white filaments of mycelia lime on ped faces; slightly effervescent in matrix and violently effervescent in lime segregations; few common slickensides; abrupt, wavy boundary.

C--36 inches, light yellowish-brown and olive-yellow (2.5Y 6/4, 6/4) soft shale, light olive brown (2.5Y 5/4, 5/6) moist; slightly calcareous shale becomes less decomposed with increasing depth.

The A horizon ranges from dark brown to brown in color and from 18 to 30 inches in thickness. It is 35 to 50 percent clay. The ACca and C horizons range in color from dark brown, light yellowish brown, or yellowish brown to olive yellow. They are commonly clay in texture but range from heavy clay loam to clay. The depth to shale ranges from 20 to 36 inches.

Included with this soil in mapping are small areas of Diablo soils, Linne soils, and Las Flores soils. Also included are areas where, as a result of past erosion, the soil is only 10 inches deep.

Fertility is medium. Permeability is slow. The available water holding capacity is 3.5 to 5.5 inches. Runoff is medium to rapid, and the erosion hazard is moderate to high. The rooting depth is 20 to 36 inches.

This soil is used mostly for range. A few small areas are used for irrigated tomatoes. Capability unit IVe-5 (19); Clayey range site.

Altamont clay, 5 to 9 percent slopes (AtC).--This soil is gently rolling and is 36 to 48 inches deep over shale. Runoff is slow to medium, and the erosion hazard is slight to moderate. The available water holding capacity is 5.5 to 7 inches. In other features, this soil is similar to Altamont clay, 15 to 30 percent slopes.

Included with this soil in mapping are small areas of Diablo soils and Las Flores soils.

This Altamont soil is used mainly for irrigated tomatoes (pl. I). Capability unit IIe-5 (19).

Altamont clay, 9 to 15 percent slopes (AtD).--This soil is strongly sloping and is 26 to 38 inches deep over shale. Runoff is medium, and the erosion hazard is moderate. The available water holding capacity is 4 to 6 inches. In other features, this soil is similar to Altamont clay, 15 to 30 percent slopes.

Included in mapping are small areas of Diablo soils and Las Flores soils.

This Altamont soil is used mainly for range and irrigated tomatoes. Capability unit IIIe-5 (19); Clayey range site.

Altamont clay, 9 to 15 percent slopes, eroded (AtD2).--This soil is strongly sloping and, because of moderate sheet erosion, is 24 to 30 inches deep over shale. Runoff is medium, and the erosion hazard is moderate. The available water holding capacity is 4 to 5 inches. In other features, this soil is similar to Altamont clay, 15 to 30 percent slopes.

Linne clay loam is the predominant soil included in mapping. In many places it occurs in eroded areas just below the ridgetops.

This Altamont soil is used mainly for range and tomatoes. Capability unit IIIE-5 (19); Clayey range site.

Altamont clay, 15 to 30 percent slopes, eroded (AtE2).--This soil is moderately steep and, because of moderate sheet erosion, is 20 to 28 inches deep over shale. The available water holding capacity is 3 to 4 inches. In other features, this soil is similar to Altamont clay, 15 to 30 percent slopes.

Linne clay loam is the predominant soil included in mapping.

This Altamont soil is used mainly for range. A few areas are used for tomatoes. Capability unit IVE-5 (19); Clayey range site.

Altamont clay, 30 to 50 percent slopes (AtF).--This soil is steep and is 20 to 32 inches deep over shale. Runoff is rapid, and the erosion hazard is high. The available water holding capacity is 3.5 to 5 inches. In other features, this soil is similar to Altamont clay, 15 to 30 percent slopes.

Included in mapping are small areas of Linne clay loam and areas where the soil is only 10 inches deep over shale.

This Altamont soil is used mainly for range. Capability unit VIe-5 (19); Clayey range site.

Anderson Series

The Anderson series consists of somewhat excessively drained very gravelly sandy loams that formed in stony, cobbly, and gravelly granitic and schist alluvium. These soils are on alluvial fans and colluvial slopes. Slopes range from 5 to 45 percent. The elevation ranges from 800 to 1,500 feet. The mean annual precipitation is between 15 and 20 inches, and the mean annual air temperature between 59° and 62° F. The frost-free season is 260 to 300 days. The vegetation in uncultivated areas is flat-top buckwheat, chamise, California sagebrush, sumac, coast live oak, and annual forbs and grasses.

In a representative profile the surface layer is brown and dark-brown, slightly acid very gravelly sandy loam about 25 inches thick. The substratum is reddish-brown and strong-brown, medium acid very gravelly coarse sandy loam. It extends to a depth of more than 60 inches.

Anderson soils are used for avocados, citrus, and range.

Anderson very gravelly sandy loam, 5 to 9 percent slopes (AuC).--This moderately sloping soil is on alluvial fans. The slope averages 6 percent.

Representative profile: 0.5 mile east of entrance to Agua Tibia Ranch on north side of Highway 76, NE 1/4 of SW 1/4 sec. 31, T. 9 S., R. 1 W.

Al--0 to 25 inches, brown and dark-brown (7.5YR 5/4 and 4/4) very gravelly sandy loam, dark brown and very dark brown (7.5YR 4/3 and 3/4) moist; very weak, medium, granular structure; soft, very friable, nonsticky, nonplastic; few

medium roots, many very fine and fine roots; many very fine and fine tubular and interstitial pores; 35 percent gravel; slightly acid (pH 6.5); clear, wavy boundary.

Cl--25 to 51 inches, reddish-brown (5YR 5/4) very gravelly coarse sandy loam, reddish brown (5YR 4/4) moist; massive; hard, friable, nonsticky, nonplastic; common very fine roots, many fine roots; common fine tubular pores; dark-red (2.5YR 3/6) clay coatings on mineral grains; 50 percent gravel; medium acid (pH 6.0); diffuse, wavy boundary.

C2--51 to 68 inches, strong-brown (7.5YR 5/6) very gravelly coarse sandy loam, strong brown (7.5YR 5/6) moist; massive; hard, friable, nonsticky, nonplastic; few very fine roots; few fine tubular pores; dark-red (2.5YR 3/6) clay coatings on mineral grains; 70 percent gravel; medium acid (pH 5.8).

The A horizon ranges from reddish brown or light brown to brown or dark brown in color, from 12 to 28 inches in thickness, and from gravelly loam to very gravelly coarse sandy loam in texture. The C horizon ranges in color from brown, strong brown, or reddish brown to yellowish red; colors of 10YR hue are included. This horizon ranges from very gravelly coarse sandy loam to cobbly loamy sand in texture. The A horizon is about 35 to 50 percent rounded gravel and strongly weathered cobblestones, and the C horizon about 50 to 70 percent.

Included with this soil in mapping are small areas of Soboda soils and Ramona soils.

Fertility is medium. Permeability is moderately rapid. The available water holding capacity is 3.5 to 5 inches. Runoff is slow, and the erosion hazard slight. Roots penetrate to a depth of more than 60 inches.

This soil is used for avocados, citrus, and range. Capability unit IVs-4 (19); Loamy range site.

Anderson very gravelly sandy loam, 9 to 45 percent slopes (AuF).--This soil is strongly sloping to steep. The surface layer is about 40 percent rounded gravelly and weathered cobblestones, and the underlying material about 50 percent. Fertility is low. The available water holding capacity is 3 to 5 inches. Runoff is medium to rapid, and the erosion hazard moderate to high. In other features, this soil is similar to Anderson very gravelly sandy loam, 5 to 9 percent slopes.

Included with this soil in mapping are small areas of Soboda soils and Ramona soils.

This Anderson soil is used for range, citrus, and avocados. Capability unit VIs-7 (19, 20); Loamy range site.

Arlington Series

The Arlington series consists of moderately well drained, moderately deep coarse sandy loams that are underlain by weakly cemented granitic alluvium. These soils are on alluvial fans and have slopes of

2 to 9 percent. The elevation ranges from 400 to 1,100 feet. The mean annual precipitation is between 12 and 15 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 260 to 320 days. The winter growing season has only light frost. The vegetation includes flatter buckwheat, filaree, wild oats, shrubs, and annual grasses and forbs.

In a representative profile the surface layer is brown, neutral coarse sandy loam about 9 inches thick. The subsoil is yellowish-brown, brown, and light yellowish-brown, slightly acid coarse sandy loam about 24 inches thick. The substratum is weakly cemented, slightly acid coarse sandy loam. It extends to a depth of 48 inches. The uppermost part is very pale brown and light yellowish brown, and the rest brownish yellow and brown.

Arlington soils are used mainly for range. Small areas are farmed to tomatoes, flowers, and truck crops.

Arlington coarse sandy loam, 2 to 9 percent slopes (AvC).--This gently sloping to moderately sloping soil is on alluvial fans. The slope averages 7 percent.

Representative profile: 175 feet southwest of farmstead, NW 1/4 of NW 1/4 sec. 1, T. 9 S., R. 3 W., by east side of private road.

A1--0 to 9 inches, brown (10YR 5/3) coarse sandy loam, dark brown (10YR 3/3) moist; weak, fine and medium, granular structure; slightly hard, friable, nonsticky, nonplastic; common very fine roots; common very fine tubular pores; neutral (pH 6.7); clear, smooth boundary.

B21t--9 to 18 inches, yellowish-brown (10YR 5/4) heavy coarse sandy loam, dark brown (10YR 4/3) moist; weak, coarse, subangular blocky structure; slightly hard, friable, nonsticky, nonplastic; common very fine roots; common very fine tubular pores; few thin clay films in pores and on ped faces; slightly acid (pH 6.5); clear, smooth boundary.

B22t--18 to 26 inches, brown (7.5YR 5/4) coarse sandy loam, dark brown (7.5YR 4/4) moist; massive; slightly hard, friable, nonsticky, nonplastic; many very fine roots; many very fine tubular pores; slightly acid (pH 6.5); clear, smooth boundary.

B3--26 to 33 inches, light yellowish-brown (10YR 6/4) coarse sandy loam, yellowish brown (10YR 5/4) moist; massive; hard, firm, nonsticky, nonplastic; few very fine roots; common very fine tubular pores; slightly acid (pH 6.5); clear, wavy boundary.

Cl si--33 to 40 inches, very pale brown (10YR 7/3) and light yellowish-brown (10YR 6/4), weakly cemented coarse sandy loam, light yellowish brown (10YR 6/4) and yellowish brown (10YR 5/6) moist; common, medium, distinct mottles; massive; very hard, firm, nonsticky, nonplastic; few very fine roots; common very fine

vesicular pores; slightly acid (pH 6/3); abrupt, wavy boundary.

C2 si--40 to 48 inches, brownish-yellow (10YR 6/6) and brown (10YR 5/3), weakly cemented coarse sandy loam, yellowish brown (10YR 5/6) and dark brown (10YR 4/3) moist; few, common, distinct mottles; massive; very hard, firm, nonsticky, nonplastic; common very fine interstitial pores; slightly acid (pH 6.3).

C3--48 to 60 inches, brownish-yellow (10YR 6/6) and brown (10YR 5/3) coarse sandy loam; massive; slightly hard, friable, nonsticky, nonplastic; common very fine interstitial pores; slightly acid (pH 6.3).

The A horizon ranges from brown to pale brown in color, from coarse sandy loam to fine sandy loam in texture, and from 8 to 12 inches in thickness. The B horizon ranges from brown or yellowish brown to light yellowish brown or reddish brown in color, from coarse sandy loam to very fine sandy loam in texture, and from 18 to 32 inches in thickness. The depth to the weakly cemented layer, or substratum, ranges from 26 to 40 inches.

Included with this soil in mapping are small areas of Greenfield soils, Ramona soils, and Visalia soils. Also included are soils that have a surface layer and subsoil of loamy sand and small areas where slopes are 9 to 15 percent.

Fertility is medium. The available water holding capacity is about 3.5 to 5 inches. Permeability is moderately rapid as far down as the weak hardpan but is slow in the pan. Runoff is slow to medium, and the erosion hazard slight to moderate. Roots penetrate to a depth of 26 to 40 inches, or as far down as the weak hardpan, which is impervious to roots in most places. During wet periods, a water table is likely to form above this hardpan.

This soil is used for range, truck crops, tomatoes, and flowers. Capability unit IIIe-8 (19); Loamy range site.

Auld Series

The Auld series consists of well-drained clays that are underlain by metavolcanic rock. These soils are on uplands and have slopes of 5 to 30 percent. The elevation ranges from 300 to 700 feet. The mean annual precipitation is between 12 and 16 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 270 to 330 days. The winter growing season has only light frost. The vegetation in uncultivated areas is chiefly wild oats, wildrye, star thistle, and scrub oak.

In a representative profile the surface layer is reddish-brown, neutral to mildly alkaline clay about 37 inches thick. The next layers are moderately alkaline, calcareous clay; the upper layer is yellow and reddish brown, and the lower layer yellow and brownish yellow. At a depth of about 54 inches is fine-grained metavolcanic rock. In some areas there are stones throughout this soil.

Auld soils are used for range, barley, and tomatoes.

Auld clay, 5 to 9 percent slopes (AWC).--This moderately sloping soil is on uplands. The slope averages 7 percent.

Representative profile: About 400 feet west of intersection of Sweetwater Road and South Bay Freeway, NW 1/4 of SE 1/4 sec. 19, T. 17 S., R. 1 W.

Ap--0 to 5 inches, reddish-brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; strong, fine and coarse, granular structure; very hard, firm, sticky, plastic; common very fine and fine roots; many very fine tubular and interstitial pores; neutral (pH 6.8); clear, smooth boundary.

A11--5 to 23 inches, reddish-brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate, coarse, subangular blocky structure; extremely hard, firm, sticky, plastic; few very fine and fine roots; few very fine tubular pores; common fine interstitial pores; mildly alkaline (pH 7.5); many slickensides; clear, wavy boundary.

A12--23 to 37 inches, reddish-brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate, medium and coarse, subangular blocky structure; extremely hard, firm, sticky, plastic; few very fine and fine roots; few very fine tubular pores; few lime mottles; slightly effervescent, mildly alkaline (pH 7.8); many slickensides; gradual, wavy boundary.

AC--37 to 45 inches, yellow (10YR 7/6) and reddish-brown (5YR 4/4) clay, yellow (10YR 7/8) and dark reddish brown (5YR 3/4) moist; weak, medium to coarse, subangular blocky structure; very hard, firm, slightly sticky, slightly plastic; very few very fine roots; very few very fine tubular pores, few fine interstitial pores; few lime mottles; slightly effervescent, moderately alkaline (pH 8.2); common slickensides; gradual, irregular boundary.

Cca--45 to 54 inches, yellow (10YR 7/6) and brownish-yellow (10YR 6/6) light clay, brownish yellow (10YR 6/6) and yellowish brown (10YR 5/6) moist; weak, coarse, subangular blocky structure; hard, friable, sticky, plastic; very few very fine roots; very few very fine tubular pores, few fine interstitial pores; common lime-segregated mottles; moderately alkaline (pH 8.2); common slickensides, abrupt, wavy boundary.

R--54 inches, altered, hard, fine-grained, greenish metavolcanic rock; somewhat shattered in upper part; nearly vertical planes in places.

The A horizon ranges from reddish brown to dark reddish brown in color; in areas where Auld soils border Diablo soils, colors of 7.5YR hue are included. This horizon ranges from 31 to 43 inches in thickness. The AC and Cca horizons range from yellow to brownish yellow or reddish brown in color and from 14 to 20 inches in thickness. The depth to bedrock ranges from 45 to more than 60 inches.

Included with this soil in mapping are small areas of Las Posas soils, Huerhuero soils, Diablo soils, and San Miguel soils. Also included are scattered rock outcrops.

Fertility is high to medium. Permeability is slow. The available water holding capacity is 7 to 9 inches. Runoff is medium, and the erosion hazard moderate. Roots penetrate down to bedrock.

This soil is used for range, small grain, and tomatoes. Capability unit IIe-5 (19); Clayey range site.

Auld clay, 9 to 15 percent slopes (AWD).--This soil is strongly sloping and in places is only 36 inches deep over bedrock. The available water holding capacity is 5.5 to 9 inches. In other features, this soil is similar to Auld clay, 5 to 9 percent slopes.

Included in mapping are small areas of Las Posas soils, Huerhuero soils, and rock outcrop.

This Auld soil is used mainly for range, barley, and tomatoes. Capability unit IIIe-5 (19); Clayey range site.

Auld stony clay, 9 to 30 percent slopes (AyE).--In contrast with Auld clay, 5 to 9 percent slopes, this soil is strongly sloping to moderately steep, is 15 to 25 percent stones, and is only 20 to 30 inches deep over bedrock. The available water holding capacity is 2 to 4 inches. Runoff is medium to rapid, and the erosion hazard moderate to high.

Included in mapping are small areas of San Miguel soils. Also included are areas where the surface layer is clay loam 3 to 5 inches thick.

This Auld soil is used only for range. Capability unit VIe-7 (19); Clayey range site.

Badland

Badland (BaG) consists of areas of essentially barren, eroded, soft shale. It occurs in the desert east of Borrego and near the Vallecitos stage station. The terrain is broken by numerous intermittent drainage channels that have cut into the soft shale. Runoff is very rapid, and the erosion hazard is very high. Also, sediment yield is very high.

Badland is of no value for farming. Capability unit VIIe-1 (30).

Bancas Series

The Bancas series consists of well-drained stony loams that have a clay loam subsoil. The soils are underlain by quartz diorite and mica schist. They are on uplands and have slopes of 5 to 65 percent. The elevation ranges from 2,000 to 5,000 feet. The mean annual precipitation is between 18 and 30 inches, and the mean annual air temperature between 56° and 58° F. The frost-free season is 175 to 230 days. The vegetation is mainly chamise, scrub oak, mountain-mahogany, manzanita, and yucca. Open areas

are in cheatgrass, wild oats, and other annual grasses and forbs.

In a representative profile the surface layer is brown, neutral stony loam and loam about 5 inches thick. The subsoil is yellowish-red and strong-brown, slightly acid clay loam about 22 inches thick. The substratum is strong-brown and brownish-yellow, slightly acid decomposed granitic rock.

Bancas soils are used mainly for wildlife habitat and watershed. A limited acreage is in range.

Bancas stony loam, 30 to 65 percent slopes (BbG).--This steep and very steep soil is on mountainous uplands. The slope averages 40 percent.

Representative profile: Las Bancas Road, SE 1/4 of NW 1/4 sec. 6, T. 16 S., R. 4 E.

A11--0 to 2 inches, brown (7.5YR 5/4) stony loam, dark brown (7.5YR 4/4) moist; weak, fine, granular structure; slightly hard, friable, slightly sticky, slightly plastic; many very fine roots, few fine roots; many very fine interstitial pores, common fine tubular pores; 15 percent stones; neutral (pH 7.0); abrupt, smooth boundary.

A12--2 to 5 inches, brown (7.5YR 5/4) loam, dark brown (7.5YR 4/4) moist; weak, fine, granular structure; hard, friable, slightly sticky, slightly plastic; many very fine roots, few fine roots; many very fine interstitial pores, common fine tubular pores; neutral (pH 7.0); abrupt, smooth boundary.

B21t--5 to 12 inches, yellowish-red (5YR 4/6) clay loam, dark red (2.5YR 3/6) moist; strong, fine, angular blocky structure; extremely hard, firm, sticky, plastic; many moderately thick clay films in pores and on ped faces; few fine and medium roots; common very fine and fine tubular pores; slightly acid (pH 6.5); clear, smooth boundary.

B22t--12 to 22 inches, yellowish-red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; strong, medium, subangular blocky structure; extremely hard, firm, sticky, plastic; many moderately thick clay films in pores, common moderately thick clay films on ped faces; very few fine roots, few medium roots; common very fine and fine tubular pores; slightly acid (pH 6.5); clear, smooth boundary.

B3t--22 to 27 inches, strong-brown (7.5YR 5/6) light clay loam, yellowish red (5YR 4/6) moist; moderate, medium, subangular blocky structure; extremely hard, firm, sticky, plastic; few thin to moderately thick clay films on ped faces; very few fine roots, few medium roots; common very fine and fine tubular pores; slightly acid (pH 6.5); clear, smooth boundary.

C--27 inches, varicolored strong-brown (7.5YR 5/8) and brownish-yellow (10YR 6/6) decomposed granitic rock, strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6) moist; thin clay films bridging sand grains; few medium roots; slightly acid (pH 6.5).

The A horizon ranges from brown to dark brown in color, from fine sandy loam to loam in texture, and from 3 to 8 inches in thickness. In most places it is 10 to 20 percent stones. The B2t horizon ranges from light clay loam to clay loam in texture, from yellowish red to strong brown in color, and from 16 to 28 inches in thickness. The depth to weathered rock is about 19 to 36 inches.

Included with this soil in mapping are small areas of Sheephead soils, Holland soils, La Posta soils, and rock land.

Fertility is low. Permeability is moderate. The available water holding capacity is 3 to 5.5 inches. Runoff is rapid to very rapid, and the erosion hazard high to very high. The rooting depth is 19 to 36 inches.

This soil is used for wildlife habitat, watershed, and range. Capability unit VIIe-7 (20); Loamy range site.

Bancas stony loam, 5 to 30 percent slopes (BbE).--This soil is gently rolling to hilly and is 24 to 39 inches deep over rock. Its surface layer is about 9 inches thick. The available water holding capacity is 3.5 to 6 inches. Runoff is medium, and the erosion hazard moderate. In other features, this soil is similar to Bancas stony loam, 30 to 65 percent slopes.

Included in mapping are small areas of Sheephead soils and Holland soils.

This Bancas soil is used mainly for range and wildlife habitat. Capability unit VIe-7 (20); Loamy range site.

Bancas stony loam, 5 to 30 percent slopes, eroded (BbE2).--This soil is gently rolling to hilly and is moderately eroded. Runoff is medium, and the erosion hazard is high. In other features, this soil is similar to Bancas stony loam, 30 to 65 percent slopes.

Included in mapping are small areas of Sheephead soils and Holland soils.

This Bancas soil is used for range, wildlife habitat, and watershed. Capability unit VIe-7 (20); Loamy range site.

Bancas stony loam, 30 to 65 percent slopes, eroded (BbG2).--This soil is steep to very steep and is 16 to 30 inches deep over rock. Sheet erosion has been moderate. The available water holding capacity is 3 to 5 inches. Runoff is very rapid, and the erosion hazard very high.

Included in mapping are small areas of La Posta soils and rock land.

This Bancas soil is used mainly for wildlife habitat, watershed, and range. Capability unit VIIe-7 (20); Loamy range site.

Blasingame Series

The Blasingame series consists of well-drained moderately deep stony loams that have a stony clay loam subsoil. These soils formed in material

weathered from basic igneous rock or meta-andesite rock. They are on uplands and have slopes of 9 to 50 percent. The elevation ranges from 800 to 2,000 feet. The mean annual precipitation is between 15 and 20 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 240 to 280 days. The vegetation is mainly chamise, flattop buckwheat, black sage, ripgut brome, and annual forbs. There are a few scattered oaks along drainageways.

In a representative profile the surface layer is brown, neutral stony loam about 5 inches thick. The subsoil is brown, reddish-brown, and strong-brown, neutral stony clay loam. At a depth of about 26 inches it grades into pale-brown, weathered meta-andesite bedrock. In some areas the surface layer is loam, instead of stony loam.

Blasingame soils are used for range, watershed, and wildlife habitat.

Blasingame stony loam, 30 to 50 percent slopes (BgF).--This steep soil is on mountainous uplands. The slope averages 40 percent.

Representative profile: End of Cold Springs Road, NW 1/4 of SE 1/4 sec. 8, T. 8 S., R. 5 W.

Al--0 to 5 inches, brown (7.5YR 5/4) stony loam, dark brown (7.5YR 4/4) moist; weak and moderate, fine, granular structure; hard, friable, slightly sticky, slightly plastic; common fine and medium roots; common fine tubular pores; 20 percent stones; neutral (pH 7.3); abrupt, wavy boundary.

B1--5 to 9 inches, brown (7.5YR 5/4) stony light clay loam, dark brown (7.5YR 4/4) moist; moderate, fine and medium, subangular blocky structure; hard, friable, sticky, plastic; common fine and medium roots; common very fine and fine tubular pores; few thin clay films on ped faces; 20 percent stones; neutral (pH 7.1); clear, wavy boundary.

B21t--9 to 15 inches, reddish-brown (5YR 4/4) stony clay loam, dark reddish brown (5YR 3/4) moist; moderate, fine and medium, subangular blocky structure; very hard, firm, sticky, plastic; few fine and medium roots; common very fine and fine tubular pores; common moderately thick clay films on ped faces; 20 percent stones; neutral (pH 6.8); clear, smooth boundary.

B22t--15 to 26 inches, strong-brown (7.5YR 5/6) stony clay loam, dark brown (7.5YR 4/4) moist; moderate, medium, subangular blocky structure; hard, friable, sticky, plastic; few medium roots; few very fine and fine tubular pores; few thin clay films on ped faces; 20 percent stones; neutral (pH 6.8); clear, smooth boundary.

C--26 inches, pale-brown (10YR 6/3) weathered meta-andesite rock, yellowish brown (10YR 5/4) moist; very few medium roots; slightly acid (pH 6.3).

The A horizon ranges from stony loam to heavy loam in texture, from brown to dark yellowish brown in color, and from 3 to 6 inches in thickness. The B1 and B2t horizons range from stony clay loam to clay loam in texture, from reddish brown to strong brown or brown in color, and from 14 to 26 inches in thickness. The depth to weathered rock ranges from 17 to 32 inches. The soil is 15 to 25 percent stones.

Included with this soil in mapping are small areas of Cieneba soils, Fallbrook soils, and Exchequer soils.

Fertility is medium. Permeability is moderately slow. The available water holding capacity is 2.5 to 3.5 inches. Runoff is rapid, and the erosion hazard high. The rooting depth is 17 to 32 inches.

This soil is used chiefly for range, watershed, and wildlife habitat. Capability unit VIIe-7 (19); Shallow Loamy range site.

Blasingame loam, 9 to 30 percent slopes (BeE).--This soil is strongly sloping to moderately steep and is 20 to 32 inches deep over weathered rock. It is not stony. The available water holding capacity is 3 to 5 inches. Runoff is medium to rapid. In other features, this soil is similar to Blasingame stony loam, 30 to 50 percent slopes.

Included in mapping are small areas of Cieneba soils and Fallbrook soils.

This Blasingame soil is used for citrus, range, watershed, and wildlife habitat. Capability unit VIe-1 (19); Shallow Loamy range site.

Blasingame stony loam, 9 to 30 percent slopes (BgE).--This soil is strongly sloping to moderately steep and is 20 to 32 inches deep over weathered rock. Runoff is medium to rapid. In other features, this soil is similar to Blasingame stony loam, 30 to 50 percent slopes.

Included in mapping are small areas of Cieneba soils and Exchequer soils.

This Blasingame soil is used for citrus, range, watershed, and wildlife habitat. Capability unit VIe-7 (19); Shallow Loamy range site.

Bonsall Series

The Bonsall series consists of moderately well drained, shallow to moderately deep sandy loams that have a heavy clay loam subsoil. Slopes are concave and range from 2 to 15 percent. The elevation ranges from 200 to 2,500 feet. The mean annual precipitation is between 12 and 16 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 260 to 340 days. The winter growing season has only light frost. The native vegetation is mainly filaree, mustard, wild oats, and annual grasses and forbs. A few scattered oaks grow along the drainageways.

In a representative profile the surface layer is brown, slightly acid sandy loam about 10 inches thick. The subsoil is brown, yellowish-brown, and

light yellowish-brown, slightly acid to moderately alkaline clay loam and sandy loam about 50 inches thick. The substratum is light-brown, mildly alkaline sandy clay loam. At a depth of about 89 inches is deeply weathered granitic rock.

Bonsall soils are used chiefly for range. Small acreages are used for dryfarmed barley and for irrigated citrus, tomatoes, and flowers.

Bonsall sandy loam, 2 to 9 percent slopes

(B1C).--This gently sloping to moderately sloping soil is on concave slopes. The slope averages 6 percent.

Representative profile: 2 1/4 miles south, 3/4 mile east of Fallbrook, NE 1/4 of SW 1/4 sec. 31, T. 9 S., R. 3 W.

- A11--0 to 6 inches, brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; moderate, fine and medium, crumb structure; hard, friable, slightly sticky, nonplastic; many very fine, fine, and medium roots; many very fine tubular and interstitial pores; slightly acid (pH 6/2); abrupt, smooth boundary.
- A12--6 to 10 inches, brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; massive; hard, friable, slightly sticky, nonplastic; common very fine, fine, and medium roots; common very fine and fine tubular pores; slightly acid (pH 6.2); abrupt, smooth boundary.
- B1t--10 to 14 inches, brown (7.5YR 5/4) heavy clay loam, dark brown (7.5YR 4/4) moist; moderate, medium, subangular blocky structure; very hard, firm, sticky, plastic; common very fine, fine, and medium roots; few fine and medium tubular pores; slightly acid (pH 6.5); clear, smooth boundary.
- B21t--14 to 27 inches, yellowish-brown (10YR 5/4) heavy clay loam, dark yellowish brown (10YR 4/4) moist; strong, coarse, blocky structure; extremely hard, very firm, sticky, plastic; few very fine, fine, and medium roots; few fine and medium tubular pores; many moderately thick clay films on ped faces; mildly alkaline (pH 7.8), slightly effervescent; clear, smooth boundary.
- B22tca--27 to 38 inches, light yellowish-brown (10YR 6/4) light clay loam, yellowish brown (10YR 5/4) moist; strong, coarse, angular blocky structure; extremely hard, very firm, sticky, plastic; few very fine, fine, and medium roots; many moderately thick clay films on ped faces; moderately alkaline (pH 8.0), strongly effervescent; clear, smooth boundary.
- B31t--38 to 48 inches, brown (7.5YR 5/4) and reddish-brown (2.5YR 5/4) sandy loam, dark brown (7.5YR 4/4) and reddish brown (2.5YR 4/4) moist; massive; very hard, firm, nonsticky, slightly plastic; few medium tubular pores; mildly alkaline (pH 7.8); clear, smooth boundary.
- B32t--48 to 60 inches, brown (7.5YR 5/4) heavy sandy loam, dark brown (7.5YR 4/4) moist; massive;

very hard, firm, nonsticky, slightly plastic; few medium tubular pores; mildly alkaline (pH 7.8); clear, smooth boundary.

IIC1--60 to 89 inches, light-brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 5/4) moist; massive; very hard, friable, slightly sticky, slightly plastic; few medium tubular pores; mildly alkaline (pH 7.8); clear, smooth boundary.

IIC2--89 inches, very pale brown (10YR 8/3), light yellowish-brown (10YR 6/4), and very dark gray (10YR 3/1) decomposed granodiorite; mildly alkaline (pH 7.5); clear, smooth boundary.

The A horizon ranges from brown or dark grayish brown to reddish brown in color, from sandy loam to loam in texture, and from 8 to 20 inches in thickness. The B horizon ranges from light yellowish brown to dark brown and from brown to reddish brown in color, from clay loam to clay in texture, and from 38 to 66 inches in thickness. The depth to weathered granitic rock ranges from 48 to 89 inches. In places there are faint lime mottles below the B horizon.

Included with this soil in mapping are small areas of Fallbrook soils, Placentia soils, and Bosanko soils.

Fertility is medium. Permeability is very slow. The available water holding capacity is 4 to 5.5 inches. Runoff is slow to medium. The erosion hazard is slight to moderate in cultivated areas. The rooting depth is 26 to 38 inches.

This soil is used for range and dryfarmed barley, and for citrus, tomatoes, and flowers. Capability unit IIIe-3 (19); Claypan range site.

Bonsall sandy loam, 2 to 9 percent slopes, eroded

(B1C2).--This soil is cut by shallow gullies. The rooting depth is 24 to 33 inches. The available water holding capacity is 4 to 5 inches. The erosion hazard is moderate. In other features, this soil is similar to Bonsall sandy loam, 2 to 9 percent slopes.

Included in mapping were small areas of Placentia soils and Bosanko soils.

This Bonsall soil is used for range and dryfarmed grain and for flowers. Capability unit IVe-3 (19); Claypan range site.

Bonsall sandy loam, 9 to 15 percent slopes,

eroded (B1D2).--This soil is strongly sloping and is cut by shallow gullies. The rooting depth is 24 to 33 inches. The available water holding capacity is 4 to 5 inches. Runoff is medium, and the erosion hazard moderate. In other features, this soil is similar to Bonsall sandy loam, 2 to 9 percent slopes.

Included in mapping are small areas of Placentia soils, Fallbrook soils, and Bosanko soils.

This Bonsall soil is used for range and dryfarmed barley and for flowers. Capability unit IVe-3 (19); Claypan range site.

Bonsall sandy loam, thick surface, 2 to 9 percent slopes (BmC).--This soil has an 18-to 32-inch surface layer. The rooting depth is 32 to 44 inches.

Fertility is high. The available water holding capacity is 5 to 6 inches. In other features, this soil is similar to Bonsall sandy loam, 2 to 9 percent slopes.

Included in mapping are small areas of Placentia sandy loam, thick surface, and of Fallbrook soils.

This Bonsall soil is used for citrus, tomatoes, and flowers, for dryfarmed barley, and for range. Capability unit IIIe-3 (19); Claypan range site.

Bonsall-Fallbrook sandy loams, 2 to 5 percent slopes (BnB).--This complex is about 50 percent Bonsall sandy loam and 45 percent Fallbrook sandy loam. It occurs on undulating uplands, at elevations of 200 to 2,500 feet. Bonsall soils occupy the swales, and Fallbrook soils the low mounds and ridges.

Included in mapping were small areas of Bosanko soils and Placentia soils.

The Bonsall soil has a surface layer of brown sandy loam about 10 inches thick, a subsoil of yellowish-brown heavy clay loam about 50 inches thick, and a light-brown sandy substratum that grades to weathered granitic rock at a depth of about 89 inches. Detailed information is given in the description of Bonsall sandy loam, 2 to 9 percent slopes.

The Fallbrook soil has a surface layer of brown sandy loam about 8 inches thick, a subsoil of reddish-brown sandy clay loam or loam, and decomposed granitic rock at a depth of about 41 inches. Detailed information about this soil is given in the description of Fallbrook sandy loam, 5 to 9 percent slopes, under the heading "Fallbrook Series."

Bonsall sandy loam is moderately well drained, is very slowly permeable in the subsoil, and has 4 to 5.5 inches of water available in the 26 to 36 inches of rooting depth.

Fallbrook sandy loam is well drained, is moderately slowly permeable in the subsoil, and has 5 to 8 inches of water available in the 32 to 60 inches of rooting depth.

For both soils fertility is medium, runoff is slow, and the erosion hazard slight.

These soils are used for dryfarmed grain and for citrus, tomatoes, and flowers. Capability unit IIIe-3 (19).

Boomer Series

The Boomer series consists of well-drained, moderately deep to deep stony loams that have a stony clay loam subsoil. These soils formed in material derived from gabbro. They are on uplands and have slopes of 2 to 65 percent. The elevation ranges from 3,200 to 5,000 feet. The mean annual precipitation is between 25 and 38 inches, and the mean annual air temperature between 53° and 56° F. The frost-free season is 135 to 175 days. The vegetation is chiefly an open stand of coniferous and broadleaf trees and woody shrubs and grasses. The main species are Jeffrey pine, ponderosa pine, black oak, canyon live oak, incense-cedar, manzanita, and annual grasses and forbs.

In a representative profile, the surface layer is dark-brown and reddish-brown, slightly acid stony loam about 8 inches thick. The subsoil is strong-brown and yellowish-red, medium acid stony loam and stony clay loam about 38 inches thick. The substratum is deeply weathered gabbro. In some areas the surface layer is loam and the entire soil is stone free.

Boomer soils are used mainly for range, woodland, and recreational areas. A few small areas are used for orchards.

Boomer stony loam, 30 to 65 percent slopes (BrG).--This steep to very steep soil is on mountainous uplands. The slope averages 33 percent.

Representative profile: Approximately 75 feet east of Engineers Road, 0.3 mile northwest of its junction with Old Mill Truck Trail, SE 1/2 sec. 30, T. 13 S., R. 3 E.

01--1 inch to 0 partially decomposed and undecomposed leaves and litter; neutral (pH 7.0).

A11--0 to 3 inches, dark-brown (10YR 4/2) stony loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, crumb structure; soft, very friable, slightly sticky, plastic; many very fine random roots; many fine interstitial pores; 20 percent stones; slightly acid (pH 6.5); abrupt, smooth boundary.

A12--3 to 8 inches, reddish-brown (5YR 4/4) stony loam, reddish brown (5YR 4/4) moist; moderate, medium, granular structure; slightly hard, friable, slightly sticky, plastic; common fine random roots; many fine interstitial pores; 20 percent stones; slightly acid (pH 6.5); clear, wavy boundary. Tongues of this horizon, possibly filled animal burrows, extend into underlying material, almost to the B2 horizon.

B1--8 to 16 inches, strong-brown (7.5YR 5/6) stony loam, dark reddish brown (5YR 3/4) moist; moderate, coarse, angular blocky structure; slightly hard, firm, slightly sticky, plastic; few medium random roots; very many fine random tubular pores; few thin clay films on ped faces; 20 percent stones; medium acid (pH 6.0); clear, wavy boundary.

B21t--16 to 31 inches, strong-brown (7.5YR 5/6) stony clay loam, dark reddish brown (5YR 3/4) moist; strong, medium, angular blocky structure; hard, firm, sticky, very plastic; few medium random roots; many fine random tubular pores; common moderately thick clay films on ped faces; 20 percent stones; medium acid (pH 6.0); clear, wavy boundary.

B22t--31 to 46 inches, yellowish-red (5YR 4/8) stony clay loam, yellowish red (5YR 4/8) moist; moderate, medium, angular blocky structure; hard, firm, sticky, very plastic; few medium random roots; many fine random tubular pores; many thick clay films on ped faces; 25 percent stones; medium acid (pH 6.0); diffuse, broken boundary.

C--46 inches, reddish-yellow (7.5YR 6/8) decomposed

gabbro, yellowish red (5YR 4/8) moist; few fine random roots; medium acid (pH 5.8).

The A horizon ranges from dark brown to reddish brown in color, from stony loam to stony fine sandy loam in texture, and from 5 to 12 inches in thickness. The B horizon ranges from strong brown to yellowish red or reddish yellow in color, is stony loam, stony clay loam, or very stony clay loam in texture, and ranges from 29 to 48 inches in thickness. The depth to weathered bedrock ranges from 33 to 53 inches.

Included with this soil in mapping are small areas of Holland soils, Crouch soils, and Sheephead soils. Also included are areas where the depth to bedrock is only 25 inches.

Fertility is medium. Permeability is moderately slow. The available water holding capacity is 3 to 6.5 inches. Runoff is rapid to very rapid, and the erosion hazard high to very high. The rooting depth is 33 to 53 inches.

Woodland site quality is class VI: average annual production is 100 board feet per acre on a fully stocked, mature stand (6). Seedling mortality is severe because of the climate. The windthrow hazard is slight. Plant competition, the equipment limitation, and the hazard of pests and disease are all severe. Jeffrey pine is suitable for planting.

This soil is used mainly for range and recreational areas. A few small areas are in apple and pear orchards. Capability unit VIIe-7 (20); Loamy range site.

Boomer loam, 2 to 9 percent slopes (BoC).--This soil is undulating to gently rolling, has an 8- to 11-inch surface layer, contains no stones, and is 36 to 56 inches deep over weathered rock. Fertility is high. The available water holding capacity is 5 to 8 inches. Runoff is slow to medium, and the erosion hazard slight to moderate. In other features, this soil is similar to Boomer stony loam, 30 to 65 percent slopes.

Included in mapping are small areas of Holland soils and Crouch soils. Also included are a few areas where the surface layer is stony loam.

Woodland site quality ranges from class V to class VI: average annual production is between 100 and 200 board feet per acre on a fully stocked, mature stand (6). Seedling mortality is severe because of the climate. The windthrow hazard and the equipment limitation are slight. Plant competition and the hazard of pests and disease are moderate. Jeffrey pine is suitable for planting.

This soil is used for recreational areas, summer cottage sites, range, and apple and pear orchards. Capability unit IIIe-1 (20); Loamy range site.

Boomer loam, 9 to 30 percent slopes (BoE).--This soil is rolling to hilly, contains no stones, and is 33 to 53 inches deep over weathered rock. The available water holding capacity is 4.5 to 7.5 inches. Runoff is medium to rapid, and the erosion hazard moderate to high. In other features, this soil is similar to Boomer stony loam, 30 to 65 percent slopes.

Included in mapping are small areas of Holland soils, Crouch soils, and Sheephead soils.

Woodland site quality ranges from class V to class VI: average annual production is between 100 to 200 board feet per acre on a fully stocked, mature stand (6). Seedling mortality is severe because of the climate. The windthrow hazard is slight, plant competition is moderate, the equipment limitation is moderate, and the hazard of pests and disease is severe. Jeffrey pine is suitable for planting.

This soil is used for recreational areas, range, summer cottage sites, and apple and peach orchards. Capability unit VIe-1 (20); Loamy range site.

Boomer stony loam, 9 to 30 percent slopes (BrE).--This soil is rolling to hilly and is 33 to 53 inches deep over weathered rock. Runoff is medium to rapid, and the erosion hazard is moderate to high. In other features, this soil is similar to Boomer stony loam, 30 to 65 percent slopes.

Included in mapping are small areas of Holland soils, Crouch soils, and Sheephead soils.

Woodland site quality ranges from class V to class VI: average annual production is between 100 and 200 board feet per acre for a fully stocked, mature stand (6). Seedling mortality is severe because of the climate. The windthrow hazard is slight, plant competition is severe, the equipment limitation is moderate, and the hazard of pests and disease is severe.

This soil is used mainly for range and recreational areas. A few small areas are in pear and apple orchards. Capability unit VIe-7 (20); Loamy range site.

Bosanko Series

The Bosanko series consists of well-drained, moderately deep clays that formed in material derived from acid igneous rock. These soils are on uplands and are undulating to hilly. Slopes range from 2 to 30 percent. The elevation ranges from 300 to 2,500 feet. The mean annual precipitation is between 12 and 18 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 260 to 320 days. The winter growing season has only light frost. The vegetation is chiefly annual grasses and scattered shrubs.

In a representative profile the surface layer is gray, slightly acid to moderately alkaline clay 23 inches thick. The next layer is brown, moderately alkaline sandy clay loam that contains numerous soft lime concretions. At a depth of about 30 inches is pale-brown, decomposed acid igneous rock. In some areas these soils have a stony surface layer.

Bosanko soils are used for range, citrus, tomatoes, grain, and grain hay.

Bosanko clay, 2 to 9 percent slopes (BsC).--This gently sloping to moderately sloping soil is on uplands. The slope averages 3 percent.

Representative profile: Approximately 3,700 feet north and 140 feet west of intersection of Haverford and Lilac Roads, SW 1/4 of NE 1/4 sec. 3, T. 13 S. R. 1 E.

Ap--0 to 5 inches, gray (10YR 5/1) clay, very dark gray (10YR 3/1) moist; moderate, fine, granular structure; very hard, firm, sticky, plastic; many very fine and fine vertical roots; many very fine and fine tubular and interstitial pores; slightly acid (pH 6.3); abrupt, smooth boundary.

A11--5 to 18 inches, gray (10YR 5/1) clay, very dark gray (10YR 3/1) moist; strong, medium and coarse, angular blocky structure; extremely hard, very firm, very sticky, very plastic; many very fine roots, common fine roots; common, very fine and fine, vertical tubular pores; neutral (pH 6.7); many slickensides; clear, smooth boundary.

A12--18 to 23 inches, gray (10YR 5/1) clay, very dark gray (10YR 3/1) moist; moderate, medium, angular blocky structure; very hard, firm, very sticky, very plastic; common very fine roots; common, very fine, vertical tubular pores, few, fine, vertical tubular pores; moderately alkaline (pH 8.0); many slickensides; clear, smooth boundary.

ACca--23 to 30 inches, brown (10YR 5/3) heavy sandy clay loam, dark brown (10YR 4/3) moist; small, rounded, white (10YR 8/1) masses of lime; weak, medium, angular blocky structure; hard, friable, sticky, plastic; very few very fine roots; common very fine tubular pores; moderately alkaline (pH 8.2); slightly effervescent; violently effervescent in lime masses; clear, irregular boundary.

C--30 inches, pale-brown (10YR 6/3), decomposed, acid igneous rock.

The A horizon ranges from gray to dark gray in color and from 17 to 29 inches in thickness. The ACca horizon ranges from brown to pale brown or grayish brown in color, and from clay loam to sandy loam in texture. In places this horizon contains soft lime concretions. The depth to decomposed rock ranges from 30 to 36 inches.

Included with this soil in mapping are small areas of Bonsall soils, Fallbrook soils, and Vista soils.

Fertility is medium. Permeability is slow. The available water holding capacity is 5 to 6 inches. Runoff is slow to medium, and the erosion hazard slight to moderate. The rooting depth is 30 to 36 inches.

This soil is used mainly for range, grain, grain hay, or pasture. Citrus and tomatoes are grown in areas where irrigation water is available. Capability unit IIIe-5 (19); Clayey range site.

Bosanko clay, 9 to 15 percent slopes (BsD).--This soil is strongly sloping and is 20 to 28 inches deep over decomposed rock. The available water holding capacity is 3.5 to 4.5 inches. Runoff is medium,

and the erosion hazard moderate. In other features, this soil is similar to Bosanko clay, 2 to 9 percent slopes.

Included in mapping are small areas of Bonsall soils, Fallbrook soils, and Vista soils.

This Bosanko soil is used for range, small grain, pasture, citrus, and tomatoes. Capability unit IIIe-5 (19); Clayey range site.

Bosanko clay, 15 to 30 percent slopes (BsE).--This soil is moderately steep and is 16 to 28 inches deep over decomposed rock. The available water holding capacity is 2.5 to 4.5 inches. Runoff is medium to rapid, and the erosion hazard moderate to high. In other features, this soil is similar to Bosanko clay, 2 to 9 percent slopes.

Included in mapping are small areas of Bonsall soils, Fallbrook soils, and Vista soils.

This Bosanko soil is used for range and tomatoes. Capability unit IVe-5 (19); Clayey range site.

Bosanko stony clay, 5 to 9 percent slopes (BtC).--In contrast with Bosanko clay, 5 to 9 percent slopes, this soil is moderately sloping, is 20 percent stones and cobblestones in the surface layer, and is 24 to 36 inches deep over decomposed rock. The available water holding capacity is 3 to 5 inches. Runoff is slow to medium, and the erosion hazard slight to moderate.

Included in mapping are small areas of Bonsall soils. Also included are areas where slopes are 9 to 15 percent.

This Bosanko soil is used for range and citrus. Capability unit IVe-5 (19); Clayey range site.

Bull Trail Series

The Bull Trail series consists of well-drained sandy loams that have a sandy clay loam subsoil. These soils are underlain by feldspathic sandy alluvium. They occur in dissected old alluvial basins and are undulating to hilly. Slopes range from 2 to 30 percent. The elevation ranges from 2,700 to 4,000 feet. The mean annual precipitation is between 16 and 22 inches, and the mean annual air temperature between 56° and 58° F. The frost-free season is 150 to 200 days. The vegetation is chiefly soft chess, stipa, flattop buckwheat, ripgut brome, and annual forbs.

In a representative profile the surface layer is grayish-brown, medium acid sandy loam about 10 inches thick. The subsoil is brown, pale-brown, and light yellowish-brown, medium acid sandy clay loam and heavy sandy loam about 22 inches thick. The substratum is light brownish-gray and pale-brown, medium acid loamy sand and sand. It extends to a depth of more than 60 inches.

Bull Trail soils are used mainly for range. A small acreage is in hay or grain crops.

Bull Trail sandy loam, 9 to 15 percent slopes, eroded (BuD2).--This rolling soil is on slightly convex slopes. The slope averages 9 percent.

Representative profile: 300 feet southwest of Mataguay Road on California Highway 79, NE 1/4 of SW 1/4 sec. 8, T. 11 S., R. 3 E.

- A1--0 to 10 inches, grayish-brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak, fine and coarse, granular structure; slightly hard, friable, nonsticky, nonplastic; common very fine and fine roots; common fine to medium tubular pores; medium acid (pH 6.0); clear, smooth boundary.
- B1--10 to 15 inches, brown (10YR 5/3) sandy clay loam, dark grayish brown (10YR 4/2) moist; weak, medium and coarse, subangular blocky structure; hard, friable, sticky, plastic; common very fine roots; common fine to medium tubular and interstitial pores; medium acid (pH 5.8); clear, smooth boundary.
- B2t--15 to 25 inches, brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; weak, medium, prismatic and moderate, medium and coarse, subangular blocky structure; hard, firm, sticky, plastic; common very fine roots; few fine tubular pores, many fine interstitial pores; common thin clay films as bridges on ped faces and in pores; medium acid (pH 5.7); clear, smooth boundary.
- B3--25 to 32 inches, pale-brown (10YR 6/3) and light yellowish-brown (10YR 6/4) heavy sandy loam, dark brown (10YR 4/3) and dark yellowish brown (10YR 4/4) moist; weak, coarse, prismatic structure; slightly hard, friable, slightly sticky, slightly plastic; few fine roots; very few fine tubular pores, common fine interstitial pores; very few thin clay films on ped faces; medium acid (pH 5.6); clear, smooth boundary.
- C1--32 to 47 inches, light brownish-gray (2.5Y 6/2 and 10YR 6/2) loamy sand, brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky, nonplastic; very few fine roots; few fine interstitial pores; medium acid (pH 5.8); clear, wavy boundary.
- C2--47 to 62 inches, pale-brown (10YR 6/3) and light brownish-gray (10YR 6/2) sand, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky, nonplastic; medium acid (pH 5.8).

The A horizon ranges from grayish brown to brown in color, from sandy loam to fine sandy loam in texture, and from 6 to 12 inches in thickness. This horizon is less than 1 percent organic matter. The B horizon ranges from brown to pale brown or light yellowish brown in color, from heavy sandy loam to sandy clay loam in texture, and from 16 to 27 inches in thickness. The C horizon ranges from loamy sand to sand in texture. It extends to a depth of more than 60 inches.

Included with this soil in mapping are small areas of Calpine soils, Mottsville soils, and La Posta soils. Also included are a few areas where the subsoil is sandy loam.

Part of the original surface layer has been removed by sheet erosion. Fertility is medium.

Permeability is moderately slow. The available water holding capacity is 6 to 7.5 inches. Runoff is medium, and the erosion hazard moderate. The rooting depth is more than 60 inches.

This soil is used only for range. Capability unit IVec-1 (20); Loamy range site.

Bull Trail sandy loam, 2 to 5 percent slopes (BuB).--This soil is undulating and is not eroded. Runoff is slow, and the erosion hazard slight. The rooting depth is 60 inches. In other features, this soil is similar to Bull Trail sandy loam, 9 to 15 percent slopes, eroded.

Included in mapping are small areas of Mottsville soils and Calpine soils.

This Bull Trail soil is used mainly for range. A small acreage is in hay or grain crops. Capability unit IIec-1 (20); Loamy range site.

Bull Trail sandy loam, 5 to 9 percent slopes (BuC).--This soil is gently rolling and is not eroded. The rooting depth is more than 60 inches. Runoff is slow to medium, and the erosion hazard slight to moderate. In other features, this soil is similar to Bull Trail sandy loam, 9 to 15 percent slopes, eroded.

Included in mapping are small areas of Mottsville soils and Calpine soils.

This Bull Trail soil is used mainly for range. A small acreage is in hay or grain crops. Capability unit IIec-1 (20); Loamy range site.

Bull Trail sandy loam, 15 to 30 percent slopes, eroded (BuE2).--This soil is hilly and contains shallow gullies. Its surface layer is 4 to 6 inches thick. The rooting depth is no more than 60 inches. Runoff is medium to rapid, and the erosion hazard moderate to high. In other features, this soil is similar to Bull Trail sandy loam, 9 to 15 percent slopes, eroded.

Included in mapping are small areas of La Posta soils.

This Bull Trail soil is used only for range. Capability unit VIec-1 (20); Loamy range site.

Calpine Series

The Calpine series consists of well-drained, very deep coarse sandy loams that formed in granitic alluvium. These soils are on alluvial fans and have slopes of 2 to 15 percent. The elevation ranges from 2,500 to 4,500 feet. The mean annual precipitation is between 11 and 18 inches, and the mean annual air temperature between 56° and 58° F. The frost-free season is 160 to 185 days. The vegetation is chiefly chamise, scrub oak, manzanita, cactus, and annual grasses and forbs.

In a representative profile the surface layer is dark grayish-brown, neutral to medium acid coarse sandy loam about 12 inches thick. The subsoil is brown, slightly acid, coarse sandy loam about 22 inches thick. The substratum is brown, neutral, stratified fine gravelly sandy loam to fine

gravelly loamy coarse sand. It extends to a depth of more than 60 inches.

Calpine soils are used for range and wildlife habitat.

Calpine coarse sandy loam, 2 to 5 percent slopes (CaB).--This gently sloping soil occurs on alluvial fans in large mountain valleys. The slope averages 4 percent.

Representative profile: Approximately 800 feet east of southwest corner of sec. 18, T. 11 S., R. 5 E.

A11--0 to 3 inches, dark grayish-brown (10YR 4/2) coarse sandy loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, crumb structure; soft, very friable, nonsticky, nonplastic; many very fine random roots; neutral (pH 7.0); clear, smooth boundary.

A12--3 to 12 inches, dark grayish-brown (10YR 4/2) coarse sandy loam, very dark grayish brown (10YR 3/2) moist; weak, fine and medium, crumb structure; slightly hard, friable, nonsticky, nonplastic; many fine random roots; few, fine, random tubular pores; medium acid (pH 6.0); clear, wavy boundary.

B21--12 to 19 inches, brown (10YR 5/3) coarse sandy loam, dark brown (7.5YR 4/4) moist; massive; slightly hard, friable, nonsticky, nonplastic; common medium random roots; many, fine, random tubular pores; colloid in bridges between mineral grains; slightly acid (pH 6.2); gradual, smooth boundary.

B22--19 to 34 inches, brown (10YR 5/3) coarse sandy loam, dark brown (7.5YR 4/4) moist; massive; very hard, friable, nonsticky, nonplastic; common medium random roots; many, fine, random tubular pores; colloid in bridges between mineral grains; slightly acid (pH 6.5); gradual, smooth boundary.

C1--34 to 48 inches, brown (10YR 5/3), stratified fine gravelly sandy loam, dark brown (10YR 4/3) moist; massive; hard, friable, nonsticky, nonplastic; common medium random roots; many, fine, random tubular pores; colloid in bridges between mineral grains; 20 percent gravel; neutral (pH 6.7); clear, wavy boundary.

C2--48 to 64 inches, brown (10YR 5/3), stratified fine gravelly loamy sand, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky, nonplastic; few medium random roots; common, fine, random tubular pores; colloid in bridges between mineral grains; 20 percent gravel; neutral (pH 6.8); abrupt, wavy boundary.

C3--64 to 72 inches, brown (10YR 5/3), stratified fine gravelly loamy coarse sand, dark brown (10YR 4/3) moist; massive; soft, very friable, nonsticky, nonplastic; very few medium random roots; few, fine, random tubular pores; 20 percent gravel; neutral (pH 6.8).

The A horizon ranges from dark grayish brown to brown in color, from coarse sandy loam to coarse

loamy sand in texture, and from 10 to 14 inches in thickness. The B horizon ranges from brown to pale brown in color and from 26 to 39 inches in thickness. The C horizon ranges from brown to pale brown in color and from fine gravelly loamy coarse sand or fine gravelly coarse sand to fine gravelly sandy loam in texture. This horizon is 15 to 25 percent gravel.

Included with this soil in mapping are small areas of Kitchen Creek soils, Mottsville soils, and La Posta soils.

Fertility is low. Permeability is moderately rapid. The available water holding capacity is 4.5 to 6.5 inches. Runoff is slow, and the erosion hazard slight. The rooting depth is more than 60 inches.

This soil is used for range and wildlife habitat. Capability unit IVec-1 (20); Loamy range site.

Calpine coarse sandy loam, 5 to 9 percent slopes (CaC).--This soil is moderately sloping. Runoff is slow to medium, and the erosion hazard slight to moderate. In other features, this soil is similar to Calpine coarse sandy loam, 2 to 5 percent slopes.

Included in mapping are small areas of La Posta soils and Kitchen Creek soils.

This Calpine soil is used for range and wildlife habitat. Capability unit IVec-1 (20); Loamy range site.

Calpine coarse sandy loam, 5 to 9 percent slopes, eroded (CaC2).--This soil is moderately sloping and has lost 25 to 50 percent of its original surface layer through sheet erosion. The available water holding capacity is 4.5 to 5.5 inches. Runoff is slow to medium, and the erosion hazard slight to moderate. In other features, this soil is similar to Calpine coarse sandy loam, 2 to 5 percent slopes.

Included in mapping are small areas of La Posta soils, Kitchen Creek soils, and Mottsville soils.

This Calpine soil is used for range and wildlife habitat. Capability unit IVec-1 (20); Loamy range site.

Calpine coarse sandy loam, 9 to 15 percent slopes, eroded (CaD2).--This soil is strongly sloping, contains rills, and shows evidence of sheet erosion. The available water holding capacity is 4.5 to 5.5 inches. Runoff is medium, and the erosion hazard moderate. In other features, this soil is similar to Calpine coarse sandy loam, 2 to 5 percent slopes.

Included in mapping are small areas of La Posta soils and Kitchen Creek soils.

This Calpine soil is used for range and wildlife habitat. Capability unit IVec-1 (20); Loamy range site.

Carlsbad Series

The Carlsbad series consists of moderately well drained and well drained gravelly loamy sands that are moderately deep over a hardpan. These soils formed in material weathered in place from soft

ferruginous sandstone. They are on ridges and in swales and have slopes of 2 to 30 percent. The elevation ranges from 50 to 500 feet. The mean annual precipitation is between 10 and 12 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 330 to 350 days. The winter growing season has only light frost. The vegetation is chiefly chamise, black sage, sumac, and annual grasses and forbs.

In a representative profile the surface layer is brown, pale brown, and very pale brown, medium acid to slightly acid gravelly loamy sand about 21 inches thick. The next layers are pale-brown, light-brown, and brown, slightly acid to strongly acid heavy loamy sand about 18 inches thick. The hardpan is at a depth of about 39 inches.

Carlsbad soils are used for citrus, flowers, and truck crops and for housing developments.

Carlsbad gravelly loamy sand, 5 to 9 percent slopes (CbC).--This moderately sloping soil is on ridges. The slope averages 5 percent.

Representative profile: About 150 feet north of water tank at Oak Ridge School near center of sec. 14, T. 13 S., R. 4 W.

A1--0 to 3 inches, brown (10YR 5/3) gravelly loamy sand, dark brown (10YR 3/3) moist; weak, fine, granular structure; slightly hard, very friable, nonsticky, nonplastic; common fine roots; many fine tubular and interstitial pores; medium acid (pH 6.0); about 20 percent concretions; abrupt, smooth boundary.

A2--3 to 21 inches, very pale brown and pale brown (10YR 7/3 and 6/3) gravelly loamy sand, yellowish brown (10YR 5/4 and 4/4) moist; massive; hard, friable, nonsticky, nonplastic; few fine and coarse roots; fine tubular and interstitial pores; slightly acid (pH 6.5); 15 percent concretions; clear, smooth boundary.

C1--21 to 31 inches, pale-brown (10YR 6/3) heavy loamy sand, dark yellowish brown (10YR 4/4) moist; massive; very hard, friable, slightly sticky, slightly plastic; few fine and coarse roots; many fine tubular and interstitial pores; slightly acid (pH 6.5); few concretions; gradual, smooth boundary.

C2--31 to 39 inches, light-brown and brown (7.5YR 6/4 and 5/4) heavy loamy sand, brown and dark brown (7.5YR 5/4 and 4/4) moist; massive; very hard, friable, slightly sticky, slightly plastic; few medium and coarse roots; common fine tubular and interstitial pores; strongly acid (pH 5.5); clear, smooth boundary.

C3si--39 to 50 inches, brown to light-brown, weakly cemented sandy duripan.

The A1 and A2 horizons range from brown to very pale brown in color and from 16 to 21 inches in thickness. These horizons are about 15 to 20 percent hard, rounded iron concretions. The C horizon ranges from brown to pale brown and light

yellowish brown in color and from 16 to 19 inches in thickness. The hardpan is generally weakly cemented and occurs at a depth of 32 to 39 inches.

Included with this soil in mapping are small areas of Chesterton soils, Marina soils, and Redding soils. Also included are areas of soils that do not have a hardpan.

Fertility is medium. Drainage is moderately good. Permeability is moderately rapid above the hardpan and very slow in the pan. The available water holding capacity is 4 to 4.5 inches. Runoff is slow to medium, and the erosion hazard slight to moderate. The rooting depth is 32 to 39 inches.

This soil is used for truck crops, citrus, flowers, and range, and for housing developments. Capability unit IIIe-8 (19); Sandy range site.

Carlsbad gravelly loamy sand, 2 to 5 percent slopes (CbB).--This soil is gently sloping and is 36 to 39 inches deep over a hardpan. Runoff is slow, and the erosion hazard slight. In other features, this soil is similar to Carlsbad gravelly loamy sand, 5 to 9 percent slopes.

Included in mapping are small areas of Chesterton soils and Marina soils. Also included are areas of soils that do not have a hardpan.

This Carlsbad soil is used for truck crops, citrus, flowers, and range. Capability unit IIIe-8 (19); Sandy range site.

Carlsbad gravelly loamy sand, 9 to 15 percent slopes (CbD).--This soil is strongly sloping and is 26 to 39 inches deep over a hardpan. The available water holding capacity is 3.5 to 4.5 inches. Runoff is medium, and the erosion hazard moderate. In other features, this soil is similar to Carlsbad gravelly loamy sand, 5 to 9 percent slopes.

Included in mapping are small areas of Chesterton soils, Marina soils, and Redding soils. Also included are areas of soils that do not have a hardpan.

This Carlsbad soil is used for citrus, flowers, and range and for housing developments. Capability unit IIVe-8 (19); Sandy range site.

Carlsbad gravelly loamy sand, 15 to 30 percent slopes (CbE).--This soil is moderately steep and is 20 to 37 inches deep over a hardpan. It is well drained. The available water holding capacity is 3 to 4.5 inches. Runoff is medium to rapid, and the erosion hazard moderate to high. In other features, this soil is similar to Carlsbad gravelly loamy sand, 5 to 9 percent slopes.

Included in mapping are small areas of Chesterton soils, Marina soils, and Redding soils. Also included are areas of soils that do not have a hardpan and areas where part of the surface layer has been removed by sheet erosion.

This Carlsbad soil is used for range and for housing developments. Capability unit VIe-8 (19); Sandy range site.

Carlsbad-Urban land complex, 2 to 9 percent slopes (CcC).--This complex occurs on ridges and in

swales, at elevations of 50 to 500 feet. Most of the landscape has been altered through cut and fill operations and leveling for building sites. Before cut and fill operations and leveling, the slope was 2 to 9 percent.

The material exposed in the cuts consists of soft ferruginous sandstone and a weakly cemented sandy hardpan. The material in the fills is a mixture of gravelly loamy sand and ferruginous sandstone. Cuts and fills should be determined by onsite investigation. Between the leveled building lots are moderately steep escarpments that are easily eroded.

The entire acreage is used for homesites.

Carlsbad-Urban land complex, 9 to 30 percent slopes (CcE).--This complex occurs on ridges, at elevations of 50 to 500 feet. Most of the landscape has been altered through cut and fill operations and leveling for building sites. Before cut and fill operations and leveling, the slope was 9 to 30 percent.

The material exposed in the cuts consists of ferruginous sandstone and a weakly cemented sandy hardpan. The material in the fills is a mixture of gravelly loamy sand and ferruginous sandstone. Cuts and fills should be determined by onsite investigation. Between the leveled building lots are very steep escarpments that are easily eroded.

The entire acreage is used for homesites.

Carrizo Series

The Carrizo series consists of excessively drained, very deep very gravelly sands. These soils were derived from granitic alluvium. They are on alluvial fans and have slopes of 0 to 9 percent. The elevation ranges from 100 to 2,000 feet. The mean annual precipitation is between 4 and 6 inches, and the mean annual air temperature between 67° and 70° F. The frost-free season is 240 to 270 days. The vegetation is chiefly creosote bush, cactus, and ocotillo.

In a representative profile the surface layer is very pale brown, moderately alkaline very gravelly sand about 8 inches thick. The next layer is very pale brown, moderately alkaline very gravelly coarse sand. It extends to a depth of more than 60 inches.

Carrizo soils are used for range and recreational areas and as a source of sand and gravel.

Carrizo very gravelly sand, 0 to 9 percent slopes (CeC).--This gently sloping to moderately sloping soil is on flood plains and alluvial fans. The slope averages 3 percent.

Representative profile: 2,900 feet east of intersection of old Borrego Valley and new Borrego Valley Roads, 50 feet north of highway, NE 1/4 of SE 1/4 sec. 23, T. 11 S., R. 6 E.

A1--0 to 8 inches, very pale brown (10YR 7/3) very gravelly sand, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky, nonplastic; few fine random roots and pores; 50

percent gravel; moderately alkaline (pH 8.2); clear, smooth boundary.

C--8 to 60 inches, very pale brown (10YR 7/3) very gravelly coarse sand, pale brown (10YR 6/3) moist; massive; soft, nonsticky, nonplastic; very few coarse random roots; 50 percent gravel; moderately alkaline (pH 8.3), effervescent.

The A horizon varies considerably in texture because of the gravel content but is typically coarse sand and gravelly sand. It ranges from 6 to 10 inches in thickness. The C horizon extends to a depth of more than 60 inches. The profile is 45 to 55 percent gravel.

Included with this soil in mapping are small areas of Mecca soils and Rositas soils.

Fertility is very low. Permeability is very rapid. The available water holding capacity is 1.5 to 3 inches. Runoff is very slow to slow, and the erosion hazard is slight. The rooting depth is more than 60 inches.

This soil is used for range and recreational areas and as a source of sand and gravel (pl. I). Capability unit VIIIs-4 (30); Sandy range site.

Chesterton Series

The Chesterton series consists of moderately well drained fine sandy loams that have a sandy clay subsoil. These soils formed in material weathered in place from soft ferruginous sandstone. They are on ridges and in swales and have slopes of 2 to 15 percent. The elevation ranges from 50 to 400 feet. The mean annual precipitation is between 10 and 12 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 330 to 350 days. The winter growing season has only slight frost. The vegetation is mostly chamise, sumac, black sage, flattop buckwheat, and annual grasses and forbs.

In a representative profile the surface layer is brown, dark-brown, and reddish-yellow, medium acid fine sandy loam about 19 inches thick. The subsoil is brown, medium acid to strongly acid sandy clay mottled with red and gray. This layer is about 15 inches thick. A hardpan occurs at a depth of about 34 inches.

Chesterton soils are used for truck crops, flowers, tomatoes, and grain crops.

Chesterton fine sandy loam, 2 to 5 percent slopes (CfB).--This soil is gently sloping. Slopes are slightly concave. They average 2 percent.

Representative profile: 2.5 miles northeast of La Jolla, 2,200 feet south of Miramar Road, 50 feet east of Genesee Avenue, NW 1/4 of NE 1/4 sec. 17, T. 15 S., R. 3 W. (Projected).

A11--0 to 7 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak, fine, granular structure; slightly hard, very friable, nonsticky, nonplastic; few very fine and fine

roots; common, fine, tubular pores; many very fine interstitial pores; medium acid (pH 6.0); few rounded iron concretions; abrupt, smooth boundary.

A12--7 to 15 inches, dark-brown (7.5YR 4/4) fine sandy loam, dark brown (7.5YR 3/4) moist; weak, fine and medium, granular structure; slightly hard, very friable, nonsticky, nonplastic; few very fine and fine roots; many fine interstitial pores, common, fine, tubular pores; medium acid (pH 6.0); many rounded iron concretions; abrupt, smooth boundary.

A2cn--15 to 19 inches, reddish-yellow (7.5YR 6/6) heavy fine sandy loam, strong brown (7.5YR 5/6) moist; massive; slightly hard, friable, nonsticky, nonplastic; few very fine and fine roots; common very fine tubular pores; medium acid (pH 5.9); abundant rounded iron concretions; abrupt, smooth boundary.

B2lt--19 to 27 inches, mottled brown (7.5YR 5/4) and red (2.5YR 5/6) sandy clay, dark brown (7.5YR 4/4) and red (2.5YR 4/6) moist; weak, coarse, prismatic and weak, coarse, angular blocky structure; very hard, firm, sticky, plastic; few very fine and fine roots; few very fine tubular and interstitial pores; common thin clay films on ped faces; medium acid (pH 5.7); few rounded iron concretions; clear, smooth boundary.

B22t--27 to 34 inches, mottled red (2.5YR 4/6), brown (10YR 5/3), and gray (5YR 5/1) sandy clay; moderate, coarse, prismatic and weak, medium, angular blocky structure; extremely hard, very firm, sticky, plastic; few very fine and fine roots; few very fine tubular and interstitial pores; common clay films on ped faces; strongly acid (pH 5.2); abrupt, wavy boundary.

Cm--34 inches, reticulate mottled, strongly cemented iron hardpan.

The A horizon ranges from brown to dark brown and reddish yellow in color, from fine sandy loam to loamy fine sand in texture, and from 12 to 24 inches in thickness. This horizon is 10 to 30 percent iron concretions. The B horizon ranges from 16 to 21 inches in thickness. Depth to the hardpan ranges from 28 to 34 inches.

Included with this soil in mapping are small areas of Carlsbad soils, Huerhuero soils, and Marina soils. Also included is 140 acres of nearly level soils, north of Oceanside and south of Agua Hedionda.

This soil is moderately fertile. The available water holding capacity is 2.5 to 5 inches; some moisture is slowly available from the sandy clay subsoil. Permeability is very slow, and runoff is slow. The erosion hazard is slight in cultivated areas. The rooting depth is 12 to 24 inches.

This soil is used for truck crops, tomatoes, flowers, barley, and range. Capability unit IVe-3 (19); Acid Claypan range site.

Chesterton fine sandy loam, 5 to 9 percent slopes (CfC).--This soil is moderately sloping. It is on

coastal ridges. Runoff is slow to medium, and the erosion hazard slight to moderate. In other features, this soil is similar to Chesterton fine sandy loam, 2 to 5 percent slopes.

Included in mapping are small areas of Huerhuero soils and Carlsbad soils.

This Chesterton soil is used for truck crops, tomatoes, flowers, and range. Capability unit IVe-3 (19); Acid Claypan range site.

Chesterton fine sandy loam, 9 to 15 percent slopes, eroded (CfD2).--This soil is strongly sloping and has lost part of its original surface layer through sheet erosion. The available water holding capacity is 2.5 to 4.5 inches. Runoff is medium, and the erosion hazard moderate. In other features, this soil is similar to Chesterton fine sandy loam, 2 to 5 percent slopes.

Included in mapping are small areas of Huerhuero soils, Carlsbad soils, and Marina soils.

This Chesterton soil is used for tomatoes, flowers, and range. Capability unit IVe-3 (19); Acid Claypan range site.

Chesterton-Urban land complex, 2 to 9 percent slopes (CgC).--This unit occurs on ridges and in swales, at elevations of 50 to 400 feet. The landscape has been altered by cut and fill operations and leveling for building sites. Before cut and fill operations and leveling, the slope was 2 to 9 percent.

The material exposed in the cuts consists of ferruginous sandstone and an iron hardpan. The material in the fills is a mixture of fine sandy loam, sandy clay, and ferruginous sandstone. Cuts and fills should be determined by onsite investigation. Between the leveled building lots are moderately steep escarpments that are easily eroded. The entire acreage is used for homesites.

Chino Series

The Chino series consists of moderately well drained fine sandy loams derived mainly from granitic alluvium. These soils are on alluvial fans and terraces and have slopes of 0 to 5 percent. The elevation ranges from 20 to 2,500 feet. The mean annual precipitation is between 12 and 20 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 250 to 340 days. Frost is light in areas near the coast and heavy in the areas inland at higher elevations. The vegetation is chiefly annual grasses and shrubs. Salt-tolerant plants grow on the saline soils.

In a representative profile the surface layer is dark grayish-brown, slightly acid fine sandy loam about 7 inches thick. The next layers are very dark gray, grayish-brown, and light brownish-gray, mildly alkaline and moderately alkaline light clay loam to a depth of about 33 inches. Below this is gray, moderately alkaline light clay loam. At a depth of about 60 inches is grayish-brown, moderately alkaline sandy loam. In some areas the soil is

silt loam throughout and is saline.

Chino soils are used for grazing and for truck crops, citrus, tomatoes, and flowers.

Chino fine sandy loam, 0 to 2 percent slopes (ChA).--This nearly level soil is on alluvial fans and terraces. The slope averages 1 percent. The soil has been drained by pumping.

Representative profile: Approximately 1/4 mile northeast from abandoned headquarters of Guejito Ranch on Guejito Creek, NE 1/4 of SE 1/4 of an assumed sec. 36, T. 11 S., R. 1 W.

A11--0 to 7 inches, dark grayish-brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak, fine, granular structure; soft, very friable, nonsticky, nonplastic; many very fine and fine random roots, few medium random roots; many very fine and fine interstitial pores; slightly acid (pH 6.3); abrupt, smooth boundary.

A12--7 to 20 inches, very dark gray (10YR 3/1) light clay loam, black (10YR 2/1) moist; moderate, coarse, prismatic and angular blocky structure; very hard, friable, slightly sticky, slightly plastic; common very fine and fine random roots; common very fine and fine tubular pores, few medium tubular pores; mildly alkaline (pH 7.8); abrupt, smooth boundary.

C1--20 to 33 inches, grayish-brown and light brownish-gray (2.5Y 6/2, 10YR 6/2) light clay loam, dark grayish brown (2.5Y 4/2, 10YR 4/2) moist; moderate, coarse, prismatic and angular blocky structure; hard, friable, slightly sticky, slightly plastic; very few very fine roots; common very fine and fine tubular pores, common medium tubular pores; disseminated lime; violently effervescent, moderately alkaline; (pH 8.2); gradual, smooth boundary.

C2--33 to 60 inches, gray (10YR 4/1) light clay loam, grayish brown (2.5Y 5/2) moist; moderate, coarse, prismatic and angular blocky structure; hard, friable, slightly sticky, slightly plastic; many very fine and fine pores; medium, disseminated, irregularly shaped lime nodules; strongly effervescent, moderately alkaline (pH 8.2); gradual, smooth boundary.

C3--60 to 72 inches, grayish-brown (10YR 5/2) sandy loam, dark grayish brown (10YR 4/3) moist; massive; soft, friable, nonsticky, nonplastic; common very fine and fine pores; strongly effervescent, moderately alkaline (pH 8.2).

The A horizon ranges from dark grayish brown through very dark gray to grayish brown in color, from fine sandy loam to clay loam in texture, and from 25 to 42 inches in thickness. Occasionally this horizon receives deposition. The C horizon ranges from gray to grayish brown or light brownish gray in color and from clay loam to sandy loam in texture. It extends to a depth of 60 inches or more.

Included with this soil in mapping are small areas of Grangeville soils, Visalia soils, and Placentia soils.

Fertility is high. Permeability is moderate. The available water holding capacity is 9.5 to 11 inches. Runoff is very slow, and the erosion hazard is slight. The rooting depth is more than 60 inches. The water table has been lowered by pumping.

This soil is used for grazing and for truck crops, citrus, tomatoes, and flowers. Capability unit I-1 (19).

Chino fine sandy loam, 2 to 5 percent slopes (ChB).--This soil is gently sloping and has slow runoff. In other features, it is similar to Chino fine sandy loam, 0 to 2 percent slopes.

Included in mapping are small areas of Grangeville soils, Visalia soils, and Placentia soils.

This Chino soil is used for grazing and for truck crops, citrus, tomatoes, and flowers. Capability unit IIe-1 (19).

Chino silt loam, saline, 0 to 2 percent slopes (CkA).--This soil is slightly saline and is silt loam to loam throughout the profile. The available water holding capacity is 7.5 to 10 inches.

Included in mapping are small areas of Grangeville soils, Visalia soils, and Placentia soils.

This Chino soil is used for pasture. Capability unit IIs-6 (19).

Cieneba Series

The Cieneba series consists of excessively drained, very shallow to shallow coarse sandy loams.

These soils formed in material weathered in place from granitic rock. They are on rolling to mountainous uplands and have slopes of 5 to 75 percent. The elevation ranges from 500 to 3,000 feet. The mean annual precipitation is between 14 and 20 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 250 to 300 days. The lower elevations have only light frost in winter. The frost hazard is more severe at the higher elevations. The vegetation is chiefly flat-top buckwheat, chamise, California sagebrush, and annual grasses and forbs.

In a representative profile the soil is brown, medium acid coarse sandy loam about 10 inches thick. Below this is weathered granodiorite.

Cieneba soils are used mainly for avocados (pl. II), range, wildlife habitat, recreational areas, and watershed. Small areas are used for citrus.

Cieneba coarse sandy loam, 15 to 30 percent slopes, eroded (C1E2).--This is a hilly soil on uplands. Slopes are dominantly 30 percent.

Representative profile: 600 feet southwest of Forest Service gate, 30 feet north of road, SE 1/4 of NE 1/4 sec. 9, T. 16 S., R. 2 E.

A1--0 to 10 inches, brown (10YR 5/3) coarse sandy loam, dark brown (10YR 3/2) moist; weak, fine, granular structure; slightly hard, friable, nonsticky, nonplastic; common very fine and fine roots; many very fine and fine interstitial

pores; medium acid (pH 6.0); abrupt, smooth boundary.
C--10 inches, light reddish-brown and reddish-brown weathered granodiorite; generally several feet deep.

The A horizon ranges from brown to grayish brown in color, from coarse sandy loam to sandy loam in texture, and from 10 to 20 inches in thickness. This horizon is less than 1 percent organic matter. The C horizon is weathered granodiorite or tonalite.

Included with this soil in mapping are small areas of Fallbrook soils, Vista soils, and Las Posas soils. Also included are areas of rock outcrop.

Fertility is low. Permeability is rapid. The available water holding capacity is 1 to 2 inches. Runoff is medium to rapid, and the erosion hazard moderate to high. The rooting depth is 10 to 20 inches. Sheet and gully erosion are evident.

This soil is used mainly for range, wildlife habitat, recreational areas, and watershed. Small areas are used for avocados. Capability unit VIe-1 (19); Shallow Loamy range site.

Cieneba coarse sandy loam, 5 to 15 percent slopes, eroded (C1D2).--This soil is rolling to hilly. Runoff is slow to medium, and the erosion hazard slight to moderate. In other features, this soil is similar to Cieneba coarse sandy loam, 15 to 30 percent slopes, eroded.

Included in mapping are small areas of Fallbrook soils, Vista soils, and Las Posas soils, and soils that have a subsoil of sandy clay loam.

This Cieneba soil is used for range, wildlife, watershed, and avocados. Capability unit VIe-1 (19); Shallow Loamy range site.

Cieneba coarse sandy loam, 30 to 65 percent slopes, eroded (C1G2).--This soil is steep to very steep. Runoff is rapid to very rapid, and the erosion hazard high to very high. In other features, this soil is similar to Cieneba coarse sandy loam, 15 to 30 percent slopes, eroded.

Included in mapping are small areas of Vista soils, Las Posas soils, and unnamed soils that have a subsoil of sandy clay loam.

This Cieneba soil is used mainly for range, wildlife habitat, and watershed. Small areas are used for avocados. Capability unit VIIe-1 (19); Shallow Loamy range site.

Cieneba rocky coarse sandy loam, 9 to 30 percent slopes, eroded (CmE2).--In contrast with Cieneba coarse sandy loam, 15 to 30 percent slopes, eroded, this soil is rolling to hilly, has rock outcrops on about 10 percent of the surface and very large granodioritic boulders on about 20 percent, and is only 5 to 15 inches deep over hard granodiorite. The available water holding capacity is 1 inch to 1.5 inches.

Included in mapping are small areas of Vista rocky coarse sandy loam and Las Posas rocky sandy loam.

This Cieneba soil is used for range, recreational areas, wildlife habitat, and watershed. Capability unit VIIs-8 (19); Shallow Loamy range site.

Cieneba very rocky coarse sandy loam, 30 to 75 percent slopes (CmrG).--In contrast with Cieneba coarse sandy loam, 15 to 30 percent slopes, eroded, this soil is steep to very steep, has rock outcrops on about 20 percent of the surface and very large granodioritic boulders on about 30 percent, and is only 5 to 15 inches deep over hard granodiorite. Runoff is rapid to very rapid, and the erosion hazard high to very high. The available water holding capacity is 1 inch to 1.5 inches.

Included in mapping are small areas of Vista rocky coarse sandy loam and Las Posas rocky sandy loam.

This Cieneba soil is used for wildlife habitat, recreational areas, watershed, and range. Capability unit VIIs-8 (19); Shallow Loamy range site.

Cieneba-Fallbrook rocky sandy loams, 9 to 30 percent slopes, eroded (CnE2).--This complex is about 55 percent Cieneba coarse sandy loam and 40 percent Fallbrook sandy loam. It occurs on uplands, at elevations of 200 to 3,000 feet. Rock outcrops cover about 5 percent of the surface, and large boulders about 10 percent.

Included in mapping are small areas of Vista rocky coarse sandy loam.

The Cieneba soil is brown coarse sandy loam about 10 inches deep over weathered granitic rock. Detailed information is given in the description of Cieneba coarse sandy loam, 15 to 30 percent slopes, eroded.

The Fallbrook soil has a surface layer of brown sandy loam about 6 inches thick and a subsoil of reddish-brown sandy clay loam. It is underlain by decomposed granitic rock at a depth of about 24 inches. Detailed information about this soil is given in the description of Fallbrook sandy loam, 5 to 9 percent slopes, under the heading "Fallbrook Series."

Cieneba coarse sandy loam is excessively drained. Permeability is moderately rapid, and the available water holding capacity is 1 inch to 1.5 inches. Fertility is low.

Fallbrook sandy loam is well drained. Permeability is moderately slow in the subsoil, and the available water holding capacity is 3 to 5 inches in the 20 to 34 inches of effective rooting depth. Fertility is medium.

For both soils runoff is medium to rapid, and the erosion hazard moderate to high. Sheet erosion and gully erosion have been moderate.

These soils are used for avocados, wildlife habitat, recreational areas, and watershed. Capability unit VIe-7 (19) and Shallow Loamy range site for Cieneba soil; Capability unit VIe-7 (19) and Loamy range site for Fallbrook soil; Capability unit VIIIs-1 (19) for Rock outcrop.

Cieneba-Fallbrook rocky sandy loams, 30 to 65 percent slopes, eroded (CnG2).--This complex is

about 55 percent Cieneba coarse sandy loam and 40 percent Fallbrook sandy loam. It occurs at elevations of 200 to 3,000 feet. Rock outcrops cover about 10 percent of the surface, and large boulders about 10 percent.

Included in mapping are small areas of Vista rocky coarse sandy loam.

Detailed information about the Cieneba soil is given in the description of Cieneba coarse sandy loam, 15 to 30 percent slopes, eroded. Detailed information about the Fallbrook soil is given in the description of Fallbrook sandy loam, 5 to 9 percent slopes, under the heading "Fallbrook Series."

Cieneba coarse sandy loam is low in fertility, is excessively drained, is moderately rapidly permeable, and has 1 inch to 1.5 inches of water available in the 5 to 15 inches of effective rooting depth.

Fallbrook sandy loam is medium in fertility, is well drained, is slowly to moderately permeable in the subsoil, and has 3 to 5 inches of water available in the 20 to 34 inches of effective rooting depth.

For both soils, runoff is rapid to very rapid and the erosion hazard high to very high. Sheet and gully erosion have been moderate.

These soils are used for avocados, wildlife habitat, recreational areas, and watershed. Capability unit VIIe-7 (19) and Shallow Loamy range site for Cieneba soil; Capability unit VIIe-7 (19) and Loamy range site for Fallbrook soil; Capability unit VIIIs-1 (19) for Rock outcrop.

Clayey Alluvial Land

Clayey alluvial land (Co) consists of moderately well drained, very deep, very dark brown to black, neutral to mildly alkaline clay loams to clays. This land type occurs as nearly level areas in narrow swales and on terraces in the foothills section of the survey Area. In many places the subsoil is stratified with lenses of clay to fine sandy loam. In a few places the soil material is calcareous. The vegetation is mainly chaparral and annual grasses and forbs.

Fertility is medium. Permeability is slow. The erosion hazard is slight.

Clayey alluvial land occurs with small areas of saline soils. It is used for truck crops and for grazing. Capability unit IIs-5 (19).

Coastal Beaches

Coastal beaches (Cr) occurs as gravelly and sandy beaches along the Pacific Ocean where the shore is washed and reworked by ocean waves. Part of this land type is likely to be covered with water during high tide and stormy periods. It supports no vegetation and is of no value for farming and ranching. Capability unit VIIIw-4 (19).

Corralitos Series

The Corralitos series consists of somewhat excessively drained, very deep loamy sands that formed in alluvium derived from marine sandstone. These soils are in narrow valleys and on small alluvial fans. They have slopes of 0 to 15 percent. The elevation ranges from 50 to 300 feet. The mean annual precipitation is between 12 and 14 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 300 to 330 days. The vegetation is mainly red brome, ripgut brome, flattop buckwheat, and shrubs.

In a representative profile the surface layer is grayish-brown, slightly acid loamy sand about 9 inches thick. The next layers are brown and pale-brown, neutral loamy sand. At a depth of about 43 inches is very pale brown, neutral sand. This layer extends to a depth of more than 60 inches.

Corralitos soils are used mostly for flowers, avocados, and citrus. A few small areas are in dry-farmed barley and beans.

Corralitos loamy sand, 9 to 15 percent slopes (CsD).--This strongly sloping soil occurs in narrow valleys. Slopes are slightly concave and average 12 percent.

Representative profile: 20 feet west of Rancho Santa Fe Road, 1,400 feet north of intersection with San Marcos Road, NE 1/4 of SW 1/4 sec. 18, T. 13 S., R. 3 W.

Ap--0 to 9 inches, grayish-brown (10YR 5/2) loamy sand, dark grayish brown (10YR 4/2) moist; weak, fine, granular structure; soft, very friable, nonsticky, nonplastic; many very fine and fine roots; many very fine and fine interstitial pores; slightly acid (pH 6.5); clear, smooth boundary.

C1--9 to 25 inches, brown (10YR 5/3) loamy sand, grayish brown (10YR 4/2) moist; massive and very weak, fine, granular structure; soft, very friable, nonsticky, nonplastic; common very fine and fine roots; many very fine and fine interstitial pores; neutral (pH 7.0); gradual, smooth boundary.

C2--25 to 43 inches, pale-brown (10YR 6/3) loamy sand, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky, nonplastic; few very fine and fine roots; common very fine and fine interstitial pores; stratified with a few lenses of sandy loam and sandy clay loam; neutral (pH 7.0); gradual, smooth boundary.

C3--43 to 72 inches, very pale brown (10YR 7/3) sand, pale brown (10YR 6/3) moist; massive; soft, very friable, nonsticky, nonplastic; few very fine and fine roots; common very fine and fine pores; neutral (pH 7.0).

The A horizon ranges from light brownish gray or pale brown to grayish brown or brown in color, from sand through loamy sand to sandy loam in texture,

and from 6 to 12 inches in thickness. The C horizon ranges from brown to pale brown or very pale brown in color. This horizon ranges from sand to loamy sand in texture and contains thin strata of sandy loam to sandy clay loam. It extends to a depth of more than 60 inches.

Included with this soil in mapping are small areas of Huerhuero soils, Las Flores soils, and Tujunga soils.

Fertility is medium. Permeability is rapid. The available water holding capacity is 3.7 to 5 inches. Runoff is medium, and the erosion hazard moderate. Roots penetrate to a depth of more than 60 inches.

This soil is used mostly for flowers, truck crops, avocados, and citrus. A few small areas are in dry-farmed barley and beans. Capability unit IVs-4 (19).

Corralitos loamy sand, 0 to 5 percent slopes (CsB).--This soil is nearly level to gently sloping and is on alluvial fans. It has a 12-inch surface layer. Runoff is slow, and the erosion hazard slight. In other features, this soil is similar to Corralitos loamy sand, 9 to 15 percent slopes.

Included in mapping are small areas of Tujunga soils, Las Flores soils, and Huerhuero soils.

This Corralitos soil is used for avocados, citrus, truck crops, and flowers. Capability unit IIIs-4 (19).

Corralitos loamy sand, 5 to 9 percent slopes (CsC).--This soil is moderately sloping. Runoff is slow to medium, and the erosion hazard slight to moderate. In other features, this soil is similar to Corralitos sandy loam, 9 to 15 percent slopes.

Included in mapping are small areas of Tujunga soils, Las Flores soils, and Huerhuero soils.

This Corralitos soil is used for avocados, citrus, truck crops, and flowers. Capability unit IIIs-4 (19).

Crouch Series

The Crouch series consists of well-drained, deep to moderately deep coarse sandy loams that formed in material weathered from acid igneous rock and micaeous schist. These soils are on mountainous uplands and have slopes of 5 to 75 percent. The elevation ranges from 3,000 to 6,000 feet. The mean annual precipitation is between 20 and 35 inches, and the mean annual air temperature between 53° and 55° F. The frost-free season is 135 to 175 days. The vegetation is chiefly semidense to open stands of timber and grass and shrubs. The dominant species are black oak, canyon live oak, Coulter pine, incense-cedar, and Jeffrey pine.

In a representative profile the surface layer is very dark grayish-brown, dark grayish-brown, and dark yellowish-brown, slightly acid coarse sandy loam about 29 inches thick. The subsoil is yellowish-brown, slightly acid sandy loam about 27 inches thick. At a depth of about 56 inches is deeply weathered granodiorite. Some areas have a fine sandy

loam surface layer and are stony throughout; other areas are rocky.

Crouch soils are used mainly for range, watershed, recreational areas, and wildlife habitat. Small selected areas are used for apple and pear orchards.

Crouch coarse sandy loam, 5 to 30 percent slopes (CtE).--This moderately sloping to hilly soil is on uplands. The slope averages 30 percent.

Representative profile: Approximately 500 feet south of the north quarter corner of sec. 29, T. 12 S., R. 4 E., about 2 miles north-northeast of Julian.

A11--0 to 3 inches, very dark grayish-brown (10YR 3/2) coarse sandy loam, very dark brown (10YR 2/2) moist; weak, very fine, crumb structure; soft, very friable, nonsticky, slightly plastic; many very fine random roots; many very fine interstitial pores; slightly acid (pH 6.5); abrupt, smooth boundary.

A12--3 to 13 inches, dark grayish-brown (10YR 4/2) coarse sandy loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, friable, nonsticky, slightly plastic; common fine random roots; common fine tubular pores; slightly acid (pH 6.5); clear, smooth boundary.

A3--13 to 29 inches, dark yellowish-brown (10YR 4/4) coarse sandy loam containing burrows filled with soil from A12 horizon, dark yellowish brown (10YR 3/4) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; common medium roots; common fine tubular pores; slightly acid (pH 6.5); clear, wavy boundary.

B1--29 to 42 inches, yellowish-brown (10YR 5/4) sandy loam, dark yellowish brown (10YR 4/4) moist; massive; hard, firm, slightly sticky, slightly plastic; few medium roots; few fine tubular pores; clay in bridges between mineral grains; slightly acid (pH 6.5); clear, wavy boundary.

B2--42 to 56 inches, yellowish-brown (10YR 5/4) sandy loam, dark yellowish brown (10YR 4/4) moist; massive; hard, firm, slightly sticky, slightly plastic; few coarse roots; common medium tubular pores; clay in bridges between mineral grains; slightly acid (pH 6.5); gradual, smooth boundary.

C1--56 inches, yellowish-brown (10YR 5/4) weathered granodiorite containing very dark grayish-brown (10YR 3/2) and very pale brown (10YR 8/4) mineral grains, dark yellowish brown (10YR 4/4) moist; few coarse roots; colloid in bridges between mineral grains; slightly acid (pH 6.5); gradual, smooth boundary.

The A horizon ranges from very dark grayish brown to dark yellowish brown or brown in color, from coarse sandy loam to sandy loam in texture, and from 20 to 33 inches in thickness. The B horizon ranges from light yellowish brown to yellowish

brown or dark yellowish brown in color, from loam to coarse sandy loam in texture, and from 22 to 32 inches in thickness. The depth to weathered rock is 42 to 60 inches.

Included with this soil in mapping are small areas of Holland soils, Boomer soils, and Sheephead soils. Also included are small areas where the surface layer is yellowish brown, the subsoil is brown or strong brown, and the texture is loam; a few areas where the subsoil contains cobblestones and gravel; and areas where the depth to bedrock is 28 to 42 inches.

Fertility is medium. The available water holding capacity is 4.5 to 7.5 inches. Permeability is moderately rapid. Runoff is medium, and the erosion hazard moderate. The rooting depth is 42 to 60 inches.

Woodland site quality ranges from class V to class VI: average annual production is about 100 to 200 board feet per acre in a fully stocked, mature stand (6). Seedling mortality is severe because of the climate. The windthrow hazard is slight, plant competition is severe, the equipment limitation is slight, and the hazard of pests and disease is severe. Jeffrey pine is suitable for planting.

This soil is used mainly for range, recreational areas, and wildlife habitat. Small selected areas on the lower slopes are used for apple or pear orchards. Cordwood is the main wood product but is of minor importance. A few saw logs are cut from dead trees. Capability unit VIe-1 (20); Loamy range site.

Crouch coarse sandy loam, 30 to 50 percent slopes (CtF).--This soil is steep and is 36 to 58 inches deep over weathered rock. The available water holding capacity is 4 to 6 inches. Runoff is rapid, and the erosion hazard high. In other features, this soil is similar to Crouch coarse sandy loam, 5 to 30 percent slopes.

Included in mapping are small areas of Holland soils, Boomer soils, and Sheephead soils.

Woodland site quality is class V: average annual production is about 100 board feet per acre on a fully stocked, mature stand (6). Seedling mortality is severe because of the climate. The windthrow hazard is slight, plant competition is severe, and the equipment limitation is severe. Jeffrey pine is suitable for planting.

This soil is used for range, wildlife habitat, and watershed. Cordwood is cut in some accessible areas, but is of minor importance. A few saw logs are cut from dead trees. Capability unit VIIe-1 (20); Loamy range site.

Crouch rocky coarse sandy loam, 5 to 30 percent slopes (CuE).--This soil is moderately sloping to moderately steep and is 36 to 60 inches deep over weathered rock. Rock outcrops cover about 10 percent of the surface, and stones and cobblestones occur throughout the profile. The available water holding capacity is 3.5 to 5.5 inches. In other features, this soil is similar to Crouch coarse sandy loam, 5 to 30 percent slopes.

Included in mapping are small areas of Holland soils, Boomer soils, and Sheephead soils.

Woodland site quality is class IV: average annual production is about 200 board feet per acre on a fully stocked, mature stand (6). Seedling mortality is severe because of the climate. The windthrow hazard is slight, plant competition is severe, the equipment limitation is slight, and the hazard of pests and disease is severe. Jeffrey pine is suitable for planting.

This soil is used for range, recreational areas, wildlife habitat, and watershed. Cordwood is harvested locally. Occasionally large dead trees are cut for saw logs. Capability unit VIe-7 (20); Loamy range site.

Crouch rocky coarse sandy loam, 30 to 70 percent slopes (CuG).--This soil is steep to very steep and is 36 to 58 inches deep over weathered rock. Rock outcrops cover about 10 percent of the surface, and stones and cobblestones occur throughout the profile. The available water holding capacity is 3.5 to 5.5 inches. Runoff is rapid to very rapid, and the erosion hazard high to very high. In other features, this soil is similar to Crouch coarse sandy loam, 5 to 30 percent slopes.

Included in mapping are small areas of Holland soils, Boomer soils, and Sheephead soils.

Woodland site quality is class V: average annual production is about 100 board feet per acre on a fully stocked, mature stand (6). Seedling mortality is severe because of the climate. The windthrow hazard is slight, and plant competition is severe. The equipment limitation is moderate to severe, depending on the slope. The hazard of pests and disease is severe. Jeffrey pine is suitable for planting.

This soil is used for range, wildlife habitat, and watershed. Cordwood is harvested locally. Occasionally large dead trees are cut for saw logs. Capability unit VIIe-7 (20); Loamy range site.

Crouch stony fine sandy loam, 30 to 75 percent slopes (CvG).--This soil is steep to very steep and is 36 to 58 inches deep over weathered rock. It formed in material weathered from micaceous schist and is 25 percent stones. The available water holding capacity is 3 to 4.5 inches. Runoff is rapid to very rapid, and the erosion hazard high to very high. In other features, this soil is similar to Crouch coarse sandy loam, 5 to 30 percent slopes.

Included in mapping are small areas of Boomer soils and Sheephead soils.

This Crouch soil is used for range, recreational areas, wildlife habitat, and watershed. Cordwood is harvested locally. A few saw logs are cut from dead trees. Capability unit VIIe-7 (20); Loamy range site.

Diablo Series

The Diablo series consists of well-drained, moderately deep to deep clays derived from soft, calcareous sandstone and shale. These soils are on

uplands and have slopes of 2 to 50 percent. The elevation ranges from 100 to 600 feet. The mean annual precipitation is between 12 and 14 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 300 to 340 days. The winter growing season has only light frost. The vegetation is chiefly annual grasses. There are scattered shrubs in eroded areas.

In a representative profile the surface layer is dark-gray, neutral and mildly alkaline clay about 27 inches thick. The next layer is light-gray, mildly alkaline, calcareous heavy sandy loam about 5 inches thick. The substratum is soft, calcareous decomposed sandstone.

Diablo soils are used mainly for range, tomatoes, and housing developments. A few small areas are in dryfarmed barley.

Diablo clay, 15 to 30 percent slopes (DaE).--This moderately steep soil is on rounded hills. The slope averages 15 percent.

Representative profile: 200 feet south of Telegraph Canyon Road and 1/4 mile west of entrance to Otay Ranch headquarters, NW 1/4 of NW 1/4 sec. 8, T. 18 S., R. 1 W.

A11--0 to 3 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; strong, fine and medium, granular structure; very hard, firm, sticky, plastic; common fine roots; many fine interstitial pores, few fine tubular pores; neutral (pH 6.8); abrupt, smooth boundary.

A12--3 to 15 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate, medium and coarse, angular blocky structure; very hard, firm, sticky, plastic; common fine roots; common very fine and micro pores, few fine tubular pores; mildly alkaline (pH 7.5); clear, smooth boundary.

A13ca--15 to 27 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; common fine mottles (10YR 5/2, 10YR 4/2) moist; weak, medium, angular blocky structure; very hard, firm, sticky, plastic; few fine roots; few very fine and micro pores, few fine tubular pores; slightly to strongly effervescent, mildly alkaline (pH 7.7); clear, wavy boundary.

ACca--27 to 32 inches, light-gray (10YR 7/2) heavy sandy loam, light brownish gray (10YR 6/2) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; slightly to strongly effervescent, mildly alkaline (pH 7.8); clear, wavy boundary.

C--32 inches, light-gray (10YR 7/2) decomposed sandstone, light brownish gray (10YR 6/2) moist; moderately alkaline (pH 7.9).

The A horizon ranges from dark gray to very dark gray in color and from 22 to 36 inches in thickness. The ACca horizon ranges from light gray to light olive gray in color, from heavy sandy loam to silty clay loam in texture, and from 3 to 7 inches in thickness. The depth to soft, calcareous shale and sandstone ranges from 25 to 36 inches.

Included with this soil in mapping are small areas of Linne soils, Altamont soils, and Olivenhain soils. Also included are areas of soils below Olivenhain soils, or adjacent to rocky or stony hills and mountains, in which cobblestones and gravel are common in the surface layer.

Fertility is medium to high. Permeability is slow. The available water holding capacity is 4 to 5 inches. Runoff is medium to rapid, and the erosion hazard moderate to high. The rooting depth is 25 to 36 inches.

This soil is used for tomatoes, housing developments, pasture, and range. Capability unit IVe-5 (19); Clayey range site.

Diablo clay, 2 to 9 percent slopes (DaC).--This soil is gently sloping to moderately sloping and is 34 to 40 inches deep over rock. The available water holding capacity is 5 to 6 inches. Runoff is slow to medium, and the erosion hazard slight to moderate. In other features, this soil is similar to Diablo clay, 15 to 30 percent slopes.

Included in mapping are small areas of Linne soils, Altamont soils, and Olivenhain soils.

This Diablo soil is used for tomatoes, dryfarmed barley, and housing developments. Capability unit IIe-5 (19).

Diablo clay, 9 to 15 percent slopes (DaD).--This soil is strongly sloping and is 26 to 37 inches deep over rock. The available water holding capacity is 4 to 5.5 inches. Runoff is medium, and the erosion hazard slight to moderate. In other features, this soil is similar to Diablo clay, 15 to 30 percent slopes.

Included in mapping are small areas of Linne soils, Altamont soils, and Olivenhain soils.

This Diablo soil is used for tomatoes, dryfarmed grain, range, and housing developments. Capability unit IIIe-5 (19); Clayey range site.

Diablo clay, 15 to 30 percent slopes, eroded (DaE2).--This soil is 20 to 32 inches deep over rock. Sheet erosion has been moderate. The available water holding capacity is 3.5 to 4.5 inches. In other features, this soil is similar to Diablo clay, 15 to 30 percent slopes.

Included in mapping are small areas of Linne clay loam, Altamont soils, and Olivenhain soils. In many places the Linne soil occurs in eroded areas just below the ridgetops.

This Diablo soil is used for range, tomatoes, dryfarmed grain, and housing developments. Capability unit IVe-5 (19); Clayey range site.

Diablo clay, 30 to 50 percent slopes (DaF).--This soil is steep and is 20 to 28 inches deep over rock. It is cobbly and gravelly in the surface layer in areas where it occurs below ridges capped with gravelly and cobbly soils. The available water holding capacity is 3.5 to 4 inches. Runoff is rapid, and the erosion hazard high. In other features, this soil is similar to Diablo clay, 15 to 30 percent slopes.

Included in mapping are small areas of Altamont soils, Olivenhain soils, and Linne soils.

This Diablo soil is used for range. Capability unit VIe-5 (19); Clayey range site.

Diablo-Olivenhain complex, 9 to 30 percent slopes (DoE).--This complex is 50 percent Diablo clay and 45 percent Olivenhain cobbly loam. It occurs on uplands, at elevations of 100 to 600 feet.

Included in mapping are small areas of Linne soils.

The Diablo soil has a surface layer of dark-gray clay about 27 inches thick. The next layer is light-gray heavy sandy loam. At a depth of about 32 inches is soft calcareous sandstone. Detailed information is given in the description of Diablo clay, 15 to 30 percent slopes.

The Olivenhain soil has a surface layer of brown cobbly loam about 10 inches thick. The subsoil is reddish-brown cobbly clay loam about 32 inches thick. The substratum is pinkish-white cobbly loam. Detailed information about this soil is given in the description of Olivenhain cobbly loam, 2 to 9 percent slopes, under the heading "Olivenhain Series."

Diablo clay is medium to high in fertility, is slowly permeable, and has 4 to 5.5 inches of water available in the 25 to 37 inches of effective rooting depth.

Olivenhain cobbly clay loam is low in fertility, is very slowly permeable in the subsoil, and has 2 to 3 inches of water available in the 20 to 40 inches of effective rooting depth.

Both soils are well drained. They have medium to rapid runoff and a moderate to high erosion hazard.

These soils are used chiefly for range. A few small areas are used for housing developments. Capability unit IVe-5 (19) and Clayey range site for Diablo clay; Capability unit VIe-7 (19) and Claypan range site for Olivenhain cobbly loam.

Diablo-Urban land complex, 5 to 15 percent slopes (DcD).--This complex occurs on uplands, at elevations of 100 to 600 feet. The landscape has been altered through cut and fill operations and leveling for building sites. Before cut and fill operations and leveling, the slope was 5 to 15 percent.

The material exposed in the cuts consists of calcareous, light-colored sandy loam, sandstone, and shale. The material in the fills is a mixture of dark-gray clay and light-gray, calcareous sandy loam, sandstone, and shale. The clay has a high shrink-swell potential. Cuts and fills should be determined by onsite investigation. Between the leveled building lots are steep escarpments that are easily eroded. The entire acreage is used for homesites.

Diablo-Urban land complex, 15 to 50 percent slopes (DcF).--This complex occurs on uplands, at elevations of 100 to 600 feet. The landscape has been altered through cut and fill operations and leveling for building sites. Before cut and fill operations and leveling, the slope was 15 to 50 percent.

The material exposed in the cuts consists of calcareous, light-colored sandy loam, sandstone, and

shale. The material in the fills is a mixture of dark-gray clay and light-gray, calcareous sandy loam, sandstone, and shale. The clay has a high shrink-swell potential. Cuts and fills should be determined by onsite investigation. Between the leveled building lots are very steep escarpments that are easily eroded. The entire acreage is used for homesites.

Elder Series

The Elder series consists of very deep, well-drained shaly fine sandy loams. These soils are derived from sediments transported from nearby mountains. They are on alluvial fans, adjacent to the ocean, and have slopes of 2 to 9 percent. The elevation ranges from 100 to 200 feet. The mean annual precipitation is between 12 and 14 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 300 to 330 days. The winter growing season has only light frost. The vegetation is mainly California sagebrush, scrub oak, and annual grasses and forbs.

In a representative profile the surface layer is dark grayish-brown, slightly acid shaly fine sandy loam about 35 inches thick. The next layer is grayish-brown, neutral shaly fine sandy loam. It extends to a depth of 60 inches or more.

The entire acreage is on Camp Pendleton; none of it is used for farming. Formerly, these soils were used for truck crops and for dryfarmed grain and beans.

Elder shaly fine sandy loam, 2 to 9 percent slopes (EdC).--This gently sloping to moderately sloping soil is on alluvial fans. The slope averages 4 percent.

Representative profile: 75 feet northwest of railroad on edge of deep wash, SE 1/4 of SW 1/4 sec. 33, T. 10 S., R. 6 W.

A11--0 to 12 inches, dark grayish-brown (10YR 4/2) shaly fine sandy loam, very dark brown (10YR 2/2) moist; moderate, fine, granular structure; slightly hard, very friable, nonsticky, nonplastic; many micro and very fine roots; many very fine and fine interstitial pores; slightly acid (pH 6.2); 20 percent shale; clear, smooth boundary.

A12--12 to 35 inches, dark grayish-brown (10YR 4/2) shaly fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak, fine and medium, granular structure; slightly hard, very friable, nonsticky, nonplastic; many very fine and fine roots; common very fine and fine interstitial pores; slightly acid (pH 6.4); 20 percent shale; abrupt, smooth boundary.

C--35 to 70 inches, grayish-brown (10YR 5/2) shaly fine sandy loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard to hard, very friable, nonsticky, nonplastic; few very fine and fine roots; few very fine

and fine interstitial and tubular pores; neutral (pH 6.6).

The A horizon ranges from dark gray to dark grayish brown in color, from shaly fine sandy loam to shaly sandy loam in texture, and from 24 to 40 inches in thickness. The C horizon ranges from grayish brown to light brownish gray in color and from shaly fine sandy loam to shaly sandy loam in texture. This horizon extends to a depth of more than 60 inches. The soil is 15 to 25 percent shale.

Fertility is high. Permeability is moderately rapid. The available water holding capacity is about 5 to 7.5 inches. Runoff is slow to medium, and the erosion hazard slight to moderate. The rooting depth is more than 60 inches.

The entire acreage is a military reservation. Capability unit IIe-1 (19).

Escondido Series

The Escondido series consists of moderately deep to deep, well-drained very fine sandy loams that formed in material weathered in place from metamorphosed sandstone. These soils are on uplands. They are gently rolling to hilly and have slopes of 5 to 30 percent. The elevation ranges from 400 to 2,800 feet. The mean annual precipitation is between 12 and 18 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 260 to 310 days. The winter growing season has only light frost. The vegetation is mainly filaree, ripgut brome, California sagebrush, wild oats, and annual grasses and forbs. There are a few scattered oaks on north-facing slopes.

In a representative profile the surface layer is dark-brown, slightly acid very fine sandy loam about 6 inches thick. The subsoil is brown, neutral very fine sandy loam about 23 inches thick. The substratum is hard, fine-grained metasedimentary rock.

Escondido soils are used mainly for range, citrus, tomatoes, and flowers. Small acreages are in barley and grain hay.

Escondido very fine sandy loam, 9 to 15 percent slopes, eroded (EsD2).--This rolling soil is on uplands. Slopes are dominantly 14 percent.

Representative profile: Approximately 400 feet southwest of Richland Road, 0.7 mile north of its intersection with Borden Road in sec. 1, T. 12 S., R. 3 W.

Ap--0 to 6 inches, dark-brown (7.5YR 4/4) very fine sandy loam, dark reddish brown (5YR 3/3) moist; weak and moderate, fine and medium, granular structure; slightly hard, friable, nonsticky, nonplastic; common very fine and fine roots; many very fine interstitial pores, common very fine and fine tubular pores; slightly acid (pH 6.5); abrupt, smooth boundary.

B21--6 to 17 inches, brown (7.5YR 4/4) very fine sandy loam, dark reddish brown (5YR 3/4)

moist; weak, medium to coarse, subangular blocky structure; slightly hard, friable, nonsticky, nonplastic; few fine and medium roots; common very fine interstitial pores, few medium and fine tubular pores; neutral (pH 6.7); gradual, smooth boundary.

B22--17 to 29 inches, brown (7.5YR 5/4) very fine sandy loam, dark reddish brown (5YR 3/4) moist; very weak and weak, coarse, subangular blocky structure; slightly hard, friable, nonsticky, nonplastic; few fine and medium roots; common very fine interstitial pores, few medium and fine tubular pores; neutral (pH 6.7); abrupt, irregular boundary.

R--29 inches, dark grayish-brown (10YR 4/2), fractured, hard metasedimentary rock.

The A horizon ranges from dark brown to yellowish brown or dark reddish brown in color, from fine sandy loam to silt loam in texture, and from 6 to 10 inches in thickness. The B horizon ranges from pale brown to dark brown, yellowish brown, or dark reddish brown in color, from fine sandy loam to silt loam in texture, and from 14 to 25 inches in thickness. The depth to hard metamorphic rock ranges from 20 to 35 inches.

Included with this soil in mapping are small areas of Fallbrook soils, Vista soils, and Friant soils. Also included are areas where the soil is 15 to 20 inches thick over bedrock.

Fertility is medium. Permeability is moderate. The available water holding capacity is 3 to 5.5 inches. Runoff is medium, and the hazard of erosion moderate. The rooting depth is 20 to 35 inches.

This soil is used mainly for citrus, tomatoes, flowers, range, barley, and grain hay. Capability unit IVe-8 (19); Loamy range site.

Escondido very fine sandy loam, 5 to 9 percent slopes (EsC).--This soil is moderately sloping, is not eroded, and is 24 to 40 inches deep over rock. The available water holding capacity is 4 to 5.5 inches. Runoff is slow to medium, and the erosion hazard slight to moderate. In other features, this soil is similar to Escondido very fine sandy loam, 9 to 15 percent slopes, eroded.

Included in mapping are small areas of Fallbrook soils, Vista soils, and Friant soils.

This Escondido soil is used for citrus, truck crops, tomatoes, and flowers. Limited acreages are used for grain hay and range. Capability unit IIIe-8 (19); Loamy range site.

Escondido very fine sandy loam, 15 to 30 percent slopes, eroded (EsE2).--This soil is moderately steep and is 20 to 34 inches deep over rock. Fertility is low. Runoff is medium to rapid, and the erosion hazard moderate to high. In other features, this soil is similar to Escondido very fine sandy loam, 9 to 15 percent slopes, eroded.

Included in mapping are small areas of Fallbrook soils, Vista soils, Friant soils, and soils that are 15 to 20 inches deep over bedrock.

This Escondido soil is used for range and citrus. Capability unit VIe-8 (19); Loamy range site.

Escondido very fine sandy loam, deep, 5 to 9 percent slopes (EvC).--This soil is gently rolling, is not eroded, has a 14- to 25-inch surface layer and a 22- to 58-inch subsoil, and is 36 to 60 inches deep over rock. The available water holding capacity is 5.5 to 9 inches. Runoff is slow to medium, and the erosion hazard slight to moderate. In other features, this soil is similar to Escondido very fine sandy loam, 9 to 15 percent slopes, eroded.

Included in mapping are small areas of Fallbrook soils, Vista soils, and Friant soils.

This Escondido soil is used for citrus, avocados, truck crops, tomatoes, flowers, and range. Capability unit IIIe-1 (19); Loamy range site.

Exchequer Series

The Exchequer series consists of shallow and very shallow, well-drained silt loams that formed in material weathered from hard metabasic rock. These soils are on mountainous uplands and have slopes of 9 to 70 percent. The elevation ranges from 400 to 3,000 feet. The mean annual precipitation is between 14 and 20 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 240 to 280 days. The vegetation is chiefly black sagebrush, California sagebrush, flattop buckwheat, sumac, and annual grasses and forbs.

In a representative profile the surface layer is yellowish-red, slightly acid silt loam about 10 inches thick. Below this is whitish and greenish hard metabasic rock that is slightly weathered in the uppermost 4 inches. Rock outcrop covers about 10 percent of the surface.

Exchequer soils are used for wildlife habitat and watershed. A limited acreage is used for range.

Exchequer rocky silt loam, 30 to 70 percent slopes (ExG).--This steep to very steep soil is on mountainous uplands. The slope averages 39 percent. Rock outcrop covers 2 to 10 percent of the surface.

Representative profile: 75 feet northeast of third set of power poles east of Santa Fe Road, about 20 feet north of trail, NE 1/4 of SW 1/4 sec. 32, T. 12 S., R. 3 W.

All--0 to 3 inches, yellowish-red (5YR 5/6) silt loam, yellowish red (10YR 4/6) moist; weak, medium, angular blocky structure; slightly hard, friable, nonsticky, nonplastic; common very fine and fine random roots; common very fine and fine pores; slightly acid (pH 6.5); clear, smooth boundary.

A12--3 to 10 inches, yellowish-red (5YR 5/8) heavy silt loam, yellowish red (5YR 4/8) moist;

weak, fine, angular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine and fine roots, very few medium roots; common very fine and fine pores; slightly acid (pH 6.3); abrupt, broken boundary.

R--10 inches, whitish and greenish hard metabasic rock; nearly vertically tilted cleavage planes; uppermost 3 to 4 inches weathered in places.

The A horizon ranges from yellowish red to reddish brown or strong brown in color, from silt loam to loam in texture, and from 8 to 13 inches in thickness.

Included with this soil in mapping are small areas of San Miguel soils, Friant soils, and Escondido soils. Also included on the very steep slopes are a very few areas of Metamorphic rock land.

Fertility is very low. Permeability is moderate. The available water holding capacity is 1 inch to 2 inches. Runoff is rapid to very rapid, and the erosion hazard high to very high. The rooting depth is 8 to 13 inches.

This soil is used mainly for wildlife habitat and watershed. A limited acreage is used for range. Capability unit VIIs-8 (19); Shallow Loamy range site.

Exchequer rocky silt loam, 9 to 30 percent slopes (ExE).--In contrast with Exchequer rocky silt loam, 30 to 70 percent slopes, this soil is on ridges and foot slopes, is strongly sloping to moderately steep, and is 8 to 17 inches deep over rock. Runoff is medium to rapid, and the erosion hazard moderate to high.

Included in mapping are small areas of San Miguel soils, Friant soils, and Escondido soils.

This Exchequer soil is used mainly for watershed and wildlife habitat. A limited acreage is used for range. Capability unit VIIs-8 (19); Shallow Loamy range site.

Fallbrook Series

The Fallbrook series consists of well-drained, moderately deep to deep sandy loams that formed in material weathered in place from granodiorite. These soils are on uplands and have slopes of 2 to 30 percent. The elevation ranges from 200 to 2,500 feet. The mean annual precipitation is between 14 and 18 inches, and the mean annual air temperature between 61° and 64° F. The frost-free season is 260 to 320 days. The winter growing season has only light frost. The vegetation is chiefly annual grasses, oak or broadleaf chaparral, and intermittent areas of chamise.

In a representative profile the surface layer is brown, slightly acid sandy loam about 6 inches thick. The subsoil is reddish-brown and light reddish-brown, slightly acid and neutral sandy clay loam and loam about 41 inches thick. Below this is decomposed granodiorite.

Fallbrook soils are used for avocado and citrus orchards, tomatoes, flowers, truck crops, grain, grain hay, and pasture.

Fallbrook sandy loam, 5 to 9 percent slopes (FaC).--This moderately sloping soil is on uplands. The slope averages 8 percent.

Representative profile: 2 1/4 miles south of Fallbrook, NE 1/4 of SW 1/4 sec. 31, T. 9 S., R. 3 W.

A11--0 to 2 inches, brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; weak, fine, crumb structure; slightly hard, very friable, nonsticky, nonplastic; many very fine and medium roots; many very fine and fine random pores; slightly acid (pH 6.4); clear, smooth boundary.

A12--2 to 6 inches, brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; massive; hard, friable, nonsticky, nonplastic; common very fine to medium roots; common very fine and fine tubular and interstitial pores; slightly acid (pH 6.4); clear, smooth boundary.

B1--6 to 12 inches, reddish-brown (5YR 5/3) sandy loam, dark reddish brown (5YR 3/3) moist; weak, coarse, subangular blocky structure; hard, friable, slightly sticky, nonplastic; plentiful very fine and fine roots; common very fine and fine tubular pores; few thin clay films in pores and bridges; slightly acid (pH 6.3); gradual, smooth boundary.

B21t--12 to 20 inches, reddish-brown (5YR 5/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; moderate, medium, angular blocky structure; very hard, firm, slightly sticky, slightly plastic; common very fine and fine roots; common very fine and fine tubular pores; continuous thick clay films on ped faces; slightly acid (pH 6.4); gradual, smooth boundary.

B22t--20 to 28 inches, reddish-brown (5YR 5/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; moderate, medium, angular blocky structure; very hard, firm, slightly sticky, slightly plastic; common very fine roots; few very fine tubular pores; continuous thick clay films on ped faces; slightly acid (pH 6.4); clear, wavy boundary.

B3--28 to 47 inches, light reddish-brown (5YR 6/4) loam, reddish brown (5YR 4/4) moist; weak, coarse, subangular blocky structure; hard, friable, slightly sticky, nonplastic; few very fine roots; few very fine tubular pores; common moderately thick clay films on ped faces; neutral (pH 6.6); gradual, smooth boundary.

C1--47 to 68 inches, light-red (2.5YR 6/6), reddish-brown (2.5YR 4/4), dark reddish-brown (5YR 3/2), and pinkish-gray (5YR 6/2) decomposed granodiorite; very few fine roots; slightly acid (pH 6.5); gradual, smooth boundary.

C2--68 to 85 inches, reddish-brown (5YR 5/4), pink (5YR 7/3), and black (N2) decomposed granodiorite; medium acid (pH 6.0); gradual, smooth boundary.

C3--85 to 90 inches +, white (N8), light brownish-gray (10YR 6/2), and black (N2) decomposed granodiorite; medium acid (pH 6.0); many feet thick.

The A horizon ranges from dark brown to brown or yellowish brown and light yellowish brown in color, from sandy loam to fine sandy loam in texture, and from 4 to 12 inches in thickness. The B horizon ranges from brown and light brown to reddish brown and reddish yellow in color, from loam to sandy clay loam in texture, and from 24 to 52 inches in thickness. In some places the decomposed granodiorite is at a depth of only 28 inches, and in other places at a depth of 60 inches or more.

Included with this soil in mapping are small areas of Vista soils, Cienega soils, Las Posas soils, and Bonsall soils.

Fertility is medium. Permeability is moderate. The available water holding capacity is 4.5 to 8 inches. Runoff is slow to medium, and the erosion hazard slight to moderate. The rooting depth is 28 to 60 inches or more.

This soil is used for citrus, avocados, truck crops, tomatoes, flowers, dryfarmed grain, and range. A few scattered areas are used for housing developments. Clean cultivated areas are easily eroded. Erosion has been only slight in areas that are protected, irrigated, and planted to orchard crops. Capability unit IIIe-1 (19); Loamy range site.

Fallbrook sandy loam, 2 to 5 percent slopes (FaB).--This soil is gently sloping and is 32 to 60 inches deep over rock. The available water holding capacity is 5 to 8 inches. Runoff is slow, and the erosion hazard slight. In other features, this soil is similar to Fallbrook sandy loam, 5 to 9 percent slopes.

Included in mapping are small areas of Bonsall soils, Vista soils, and Las Posas soils.

This Fallbrook soil is used mainly for avocados, citrus, truck crops, tomatoes, flowers, and dryfarmed grain. Small areas are used for housing developments. Capability unit IIe-1 (19).

Fallbrook sandy loam, 5 to 9 percent slopes, eroded (FaC2).--This soil is 27 to 57 inches deep over rock. Sheet and gully erosion have been moderate. The available water holding capacity is 4.5 to 7.5 inches. In other features, this soil is similar to Fallbrook sandy loam, 5 to 9 percent slopes.

Included in mapping are small areas of Bonsall soils, Vista soils, Las Posas soils, and Cienega soils.

This Fallbrook soil is used mainly for avocados, citrus, truck crops, tomatoes, flowers, dryfarmed grain, and range. Small areas are used for housing

developments. Capability unit IIIe-1 (19); Loamy range site.

Fallbrook sandy loam, 9 to 15 percent slopes, eroded (FaD2).--This soil is strongly sloping and is 27 to 57 inches deep over rock. Sheet and gully erosion have been moderate. The available water holding capacity is 4.5 to 7.5 inches. Runoff is medium, and the erosion hazard moderate. In other features, this soil is similar to Fallbrook sandy loam, 5 to 9 percent slopes.

Included in mapping are small areas of Bonsall soils, Vista soils, Las Posas soils, and Cienega soils.

This Fallbrook soil is used mainly for avocados, citrus, tomatoes, flowers, dryfarmed grain, and range. Small areas are used for housing developments. Capability unit IVe-1 (19); Loamy range site.

Fallbrook sandy loam, 15 to 30 percent slopes, eroded (FaE2).--This soil is moderately steep and is 27 to 50 inches deep over rock. Rill and gully erosion have been moderate. The available water holding capacity is 4.5 to 6 inches. Runoff is medium to rapid, and the erosion hazard moderate to high. In other features, this soil is similar to Fallbrook sandy loam, 5 to 9 percent slopes.

Included in mapping are small areas of Bonsall soils, Vista soils, Las Posas soils, and Cienega soils.

This Fallbrook soil is used for avocados, citrus, and range. Capability unit VIe-1 (19); Loamy range site.

Fallbrook sandy loam, 9 to 30 percent slopes, severely eroded (FaE3).--This soil is strongly sloping to moderately steep and is 20 to 30 inches deep over rock. It has lost most of its original surface layer and in places as much as half the subsoil through rill and gully erosion. Fertility is low. The available water holding capacity is 3.5 to 4.5 inches. Runoff is medium to rapid, and the erosion hazard moderate to high. In other features, this soil is similar to Fallbrook sandy loam, 5 to 9 percent slopes.

Included in mapping are small areas of Vista soils, Las Posas soils, and Cienega soils.

This Fallbrook soil is used for range and vineyards. Persistent clean tillage of dryfarmed vineyards has resulted in severe loss of soil through erosion (pl. II). Capability unit VIIe-1 (19); Shallow Loamy range site.

Fallbrook rocky sandy loam, 5 to 9 percent slopes (FeC).--This soil is 20 to 36 inches deep over rock. Large boulders cover 10 to 25 percent of the surface, and rock outcrops 10 percent. Natural fertility is low. The available water holding capacity is 3 to 5 inches. In other features, this soil is similar to Fallbrook sandy loam, 5 to 9 percent slopes.

Included in mapping are small areas of Cienega soils, Las Posas soils, and Vista soils.

This Fallbrook soil is used mainly for range. Avocados and citrus are grown in areas where rocks and boulders are not too numerous. Capability unit VIe-7 (19); Loamy range site.

Fallbrook rocky sandy loam, 9 to 30 percent slopes (FeE).--This soil is strongly sloping to moderately steep and is 20 to 34 inches deep over rock. Large boulders cover 10 to 25 percent of the surface, and rock outcrops 10 percent. Natural fertility is low. The available water holding capacity is 3 to 5 inches. Runoff is medium to rapid, and the erosion hazard moderate to high. In other features, this soil is similar to Fallbrook sandy loam, 5 to 9 percent slopes.

Included in mapping are small areas of Cienega soils, Las Posas soils, and Vista soils.

This Fallbrook soil is used mainly for range. Avocados and citrus are grown in areas where rocks and boulders are not too numerous. Capability unit VIe-7 (19); Loamy range site.

Fallbrook rocky sandy loam, 9 to 30 percent slopes, eroded (FeE2).--This soil is strongly sloping to moderately steep and is 20 to 30 inches deep over rock. Sheet erosion has been moderate. Large boulders cover 10 to 25 percent of the surface, and rock outcrops 10 percent. Natural fertility is low. The available water holding capacity is 3 to 5 inches. Runoff is medium to rapid, and the erosion hazard moderate to high. In other features, this soil is similar to Fallbrook sandy loam, 5 to 9 percent slopes.

Included in mapping are small areas of Cienega soils, Las Posas soils, and Vista soils.

This Fallbrook soil is used mainly for range. Avocados and citrus are grown in areas where rocks and boulders are not too numerous. Capability unit VIe-7 (19); Loamy range site.

Fallbrook-Vista sandy loams, 9 to 15 percent slopes (FvD).--This complex occurs on uplands, at elevations of 200 to 3,000 feet. It is about 50 percent Fallbrook sandy loam and 40 percent Vista sandy loam.

Included in mapping are small areas of Cienega soils and Las Posas soils.

The Fallbrook soil has a surface layer of brown sandy loam about 8 inches thick. The subsoil is reddish-brown sandy clay loam and loam. Below this, at a depth of about 41 inches, is decomposed granitic rock. Detailed information is given in the description of Fallbrook sandy loam, 5 to 9 percent slopes.

The Vista soil has a surface layer of dark-brown sandy loam about 19 inches thick. The subsoil is dark-brown coarse sandy loam about 16 inches thick. The substratum is strongly weathered granitic rock. Detailed information about this soil is given in the description of Vista coarse sandy loam, 9 to 15 percent slopes, under the heading "Vista Series."

Fallbrook sandy loam is moderately permeable in the subsoil and has 4 to 7.5 inches of water

available in the 30 to 57 inches of effective rooting depth.

Vista sandy loam is moderately rapidly permeable in the subsoil and has 4 to 5.5 inches of water available in the 30 to 47 inches of effective rooting depth.

Both soils are well drained. Fertility is medium. Runoff is medium, and the erosion hazard moderate.

These soils are used mainly for avocados, tomatoes, flowers, and small grain. Capability unit IVE-1 (19).

Fallbrook-Vista sandy loams, 15 to 30 percent slopes (FvE).--This complex occurs on uplands, at elevations of 200 to 3,000 feet. It is about 50 percent Fallbrook sandy loam and 40 percent Vista sandy loam.

Included in mapping are small areas of Cienega soils and Las Posas soils.

Detailed information about the Fallbrook soil is given in the description of Fallbrook sandy loam, 5 to 9 percent slopes. Detailed information about the Vista soil is given in the description Vista coarse sandy loam, 9 to 15 percent slopes, under the heading "Vista Series."

Fallbrook sandy loam is moderately permeable in the subsoil and has 4.5 to 6 inches of water available in the 27 to 50 inches of rooting depth.

Vista sandy loam is moderately rapidly permeable in the subsoil and has 3.5 to 5.5 inches of water available in the 20 to 42 inches of rooting depth.

Both soils are well drained. Fertility is medium. Runoff is medium to rapid, and the erosion hazard moderate to high.

These soils are used mainly for citrus and avocados. Capability unit VIe-1 (19).

Friant Series

The Friant series consists of shallow and very shallow, well-drained fine sandy loams that formed in material weathered from fine-grained metasedimentary rock. These soils are on mountainous uplands and have slopes of 9 to 70 percent. The elevation ranges from 500 to 3,500 feet. The mean annual precipitation is between 14 and 20 inches, and the mean annual air temperature between 59° and 62° F. The frost-free season is 240 to 280 days. The vegetation is mainly California sagebrush, flattop buckwheat, white sage, wild oats, stipa, and annual grasses and forbs.

In a representative profile the surface layer is dark-brown and brown, slightly acid fine sandy loam about 12 inches thick. It is underlain by gray, hard metasedimentary rock. Rock outcrop covers 2 to 10 percent of the surface in some areas.

Friant soils are used mainly for watershed and wildlife habitat. A limited acreage is used for range.

Friant fine sandy loam, 30 to 50 percent slopes (FwF).--This steep soil is on mountainous uplands. The slope averages 40 percent.

Representative profile: 100 feet north of barbed wire fence, 75 feet west of Mother Grundy Road, NW 1/4 of SW 1/4 sec. 2, T. 18 S., R. 2 E.

A11--0 to 3 inches, dark-brown (10YR 4/4) fine sandy loam, dark brown (10YR 3/3) moist; weak, very fine and fine, granular structure; slightly hard, friable, nonsticky, nonplastic; common fine roots; many very fine interstitial pores, common fine tubular pores; slightly acid (pH 6.4); abrupt, smooth boundary.

A12--3 to 12 inches, brown (10YR 5/3) heavy fine sandy loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable, nonsticky, nonplastic; few fine roots, plentiful fine roots; common fine tubular pores, common very fine interstitial pores; slightly acid (pH 6.2); abrupt, irregular boundary.

R--12 inches, gray metasedimentary rock that is slightly tilted.

The A horizon ranges from dark brown to brown in color, from very fine sandy loam to sandy loam in texture, and from 3 to 15 inches in thickness. The depth to hard rock is 3 to 15 inches.

Included with this soil in mapping are small areas of Exchequer soils, Escondido soils, and Cienega soils. Also included are areas of rock outcrop.

Fertility is low. Permeability is moderately rapid. The available water holding capacity is 1 inch to 2 inches. Runoff is rapid, and the erosion hazard high. The rooting depth is 3 to 15 inches.

This soil is used mainly for watershed and wildlife habitat. A limited acreage is in range. Capability unit VIIs-8 (19); Shallow Loamy range site.

Friant rocky fine sandy loam, 9 to 30 percent slopes (FxE).--This soil is rolling to hilly and is 3 to 12 inches deep over hard rock. The available water holding capacity is 0.5 inch to 1.5 inches. Runoff is medium to rapid, and the erosion hazard moderate to high. Rock outcrop covers 2 to 10 percent of the surface. In other features, this soil is similar to Friant fine sandy loam, 30 to 50 percent slopes.

Included in mapping are small areas of Exchequer soils, Escondido soils, and Cienega soils.

This Friant soil is used mainly for watershed and wildlife habitat. A limited acreage is in range. Capability unit VIIs-8 (19); Shallow Loamy range site.

Friant rocky fine sandy loam, 30 to 70 percent slopes (FxG).--This soil is steep to very steep and is 3 to 12 inches deep over hard rock. The available water holding capacity is 0.5 inch to 1.5 inches. Runoff is rapid to very rapid, and the erosion hazard high to very high. Rock outcrop covers 2 to 10 percent of the surface. In other features, this soil is similar to Friant fine sandy loam, 30 to 50 percent slopes.

Included in mapping are small areas of Exchequer soils, Escondido soils, and Cienega soils.

This Friant soil is used mainly for watershed and wildlife habitat. A limited acreage is in range. Capability unit VIIIs-8 (19); Shallow Loamy range site.

Gaviota Series

The Gaviota series consists of well-drained, shallow fine sandy loams that formed in material weathered from marine sandstone. These soils are on uplands and have slopes of 9 to 50 percent. The elevation ranges from 300 to 500 feet. The mean annual precipitation is between 10 and 12 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 280 to 320 days. The vegetation is mainly chamise, cactus, scrub oak, sumac, flattop buckwheat, and annual grasses and forbs.

In a representative profile the surface layer is brown and yellowish-brown, mildly alkaline fine sandy loam about 16 inches thick. The substratum is very pale brown semiconsolidated sandstone.

Gaviota soils are used for range, watershed, and small housing developments.

Gaviota fine sandy loam, 9 to 30 percent slopes (GaE).--This rolling to hilly soil is on uplands. The slope averages 27 percent.

Representative profile: 250 feet south of Telegraph Canyon Road, 200 feet east of private drive, NE 1/4 of NE 1/4 sec. 12, T. 18 S., R. 2 W.

A11--0 to 4 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak, fine and medium, subangular blocky and granular structure; slightly hard, very friable, non-sticky, nonplastic; common very fine and fine roots; common very fine and fine interstitial pores; slightly effervescent, mildly alkaline (pH 7.5); clear, smooth boundary.

A12--4 to 16 inches, yellowish-brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; very weak, medium and coarse, subangular blocky structure slightly hard, very friable, nonsticky, nonplastic; few very fine and fine roots; few very fine and fine pores; slightly effervescent, mildly alkaline (pH 7.5); abrupt, wavy boundary.

R--16 inches, very pale brown (10YR 7/4) and light yellowish-brown (10YR 6/4) semiconsolidated sandstone.

The A horizon ranges from brown to dark brown or yellowish brown in color, from fine sandy loam to sandy loam in texture, and from 9 to 20 inches in thickness.

Included with this soil in mapping are small areas of Linne soils, Diablo soils, and Huerhuero soils. Also included are areas of soils that are 5 to 9 inches thick but are otherwise like Gaviota soils.

Fertility is low. Permeability is moderately rapid. The available water holding capacity is 1 inch to 2 inches. Runoff is medium to rapid, and the erosion hazard moderate to high. The rooting depth is 9 to 20 inches.

This soil is used mainly for watershed and small housing developments. A limited acreage is in range. Capability unit VIe-8 (19); Shallow Loamy range site.

Gaviota fine sandy loam, 30 to 50 percent slopes (GaF).--This soil is steep and is 9 to 18 inches deep over sandstone. Runoff is rapid, and the erosion hazard is high. In other features, this soil is similar to Gaviota fine sandy loam, 9 to 30 percent slopes.

Included in mapping are small areas of Linne soils, Diablo soils, and Huerhuero soils.

This Gaviota soil is used for range and watershed. Capability unit VIIe-8 (19); Shallow Loamy range site.

Grangeville Series

The Grangeville series consists of somewhat poorly drained, very deep fine sandy loams derived from granitic alluvium. These soils are on alluvial fans and alluvial plains and have slopes of 0 to 2 percent. The elevation ranges from 50 to 200 feet. The mean annual precipitation is between 10 and 16 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 260 to 300 days. The winter growing season has only light frost. The vegetation is chiefly annual grasses and forbs.

In a representative profile the surface layer is grayish-brown, moderately alkaline, calcareous fine sandy loam about 11 inches thick. The next layer is grayish-brown, moderately alkaline, calcareous fine sandy loam about 23 inches thick. The substratum is grayish-brown, moderately alkaline, calcareous very fine sandy loam. It extends to a depth of more than 60 inches.

Grangeville soils are used for pasture, truck crops, tomatoes, and flowers.

Grangeville fine sandy loam, 0 to 2 percent slopes (GoA).--This nearly level soil is on alluvial fans and alluvial plains. The slope averages 2 percent.

Representative profile: South bank of the San Dieguito River valley, 0.8 mile east of El Camino Real, NW 1/4 of NW 1/4 sec. 8, T. 14 S., R. 3 W.

Ap--0 to 11 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak, fine, subangular blocky structure; hard, firm, slightly sticky, slightly plastic; common very fine roots; common very fine tubular pores; disseminated lime; very slightly effervescent, moderately alkaline (pH 8.0); clear, wavy boundary.

C1--11 to 34 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR

3/2) moist; massive; soft, friable, slightly sticky, slightly plastic; common very fine and coarse roots; many micro interstitial pores; disseminated lime; very slightly effervescent, moderately alkaline (pH 8.2); gradual, wavy boundary.

C2--34 to 60 inches, grayish-brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; massive; soft, friable, slightly sticky, slightly plastic; common very fine roots; many micro interstitial pores; disseminated lime; slightly effervescent, moderately alkaline (pH 8.2).

The A horizon ranges from grayish brown to gray in color, from fine sandy loam to sandy loam in texture, and from 10 to 14 inches in thickness. The C horizon ranges from grayish brown to dark grayish brown in color and from very fine sandy loam to sandy loam in texture. It extends to a depth of more than 60 inches.

Included with this soil in mapping are small areas of Visalia soils, Chino soils, and Tujunga soils.

Fertility is high. Permeability is moderately rapid. The available water holding capacity is 6 to 8.5 inches. Runoff is very slow, and the erosion hazard slight. The rooting depth is more than 60 inches. A seasonal high water table occurs at a depth of 1 to 4 feet.

Part of the acreage is used for truck crops, pasture, tomatoes, and flowers. The rest is used as recreational areas, including golf courses. Capability unit IIw-2 (19).

Greenfield Series

The Greenfield series consists of well-drained, very deep sandy loams derived from granitic alluvium. These soils are on alluvial fans and alluvial plains and have slopes of 0 to 15 percent. The elevation ranges from 400 to 800 feet. The mean annual precipitation is between 14 and 18 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 260 to 320 days. The winter growing season has only light frost. The vegetation is chiefly soft chess, wild oats, ripgut brome, mustard, foxtail, filaree, and coast live oak.

In a representative profile the surface layer is brown, slightly acid sandy loam about 6 inches thick. The subsoil is yellowish-brown and light yellowish-brown, slightly acid sandy loam about 28 inches thick. The substratum is light yellowish-brown, neutral loamy coarse sand. It extends to a depth of more than 60 inches.

Greenfield soils are used for range, improved pasture, dryfarmed grain, citrus, truck crops, flowers, avocados, stone fruits, and tomatoes.

Greenfield sandy loam, 2 to 5 percent slopes (GrB).--This gently sloping soil is on alluvial fans and alluvial plains. The slope averages 3 percent.

Representative profile: 600 feet south, 800 feet east of west quarter corner, NW 1/4 of SW 1/4 sec. 36, T. 13 S., R. 1 W.

A1--0 to 6 inches, brown (10YR 5/3) sandy loam, dark yellowish brown (10YR 4/4) moist; very weak, fine and medium, granular structure; slightly hard, very friable, slightly sticky, nonplastic; few medium roots, common fine roots; many very fine interstitial pores; slightly acid (pH 6.2); clear, smooth boundary.

B1--6 to 22 inches, yellowish-brown (10YR 5/4) sandy loam, dark yellowish brown (10YR 4/4) moist; weak, fine and medium, subangular blocky structure; slightly hard, very friable, slightly sticky, nonplastic; common fine roots, few medium and coarse roots; common fine interstitial and tubular pores; very few thin clay films on ped faces; slightly acid (pH 6.3); clear, smooth boundary.

B2t--22 to 34 inches, light yellowish-brown (10YR 6/4) sandy loam, yellowish brown (10YR 5/4) moist; weak, fine and medium, subangular blocky structure; slightly hard, very friable, slightly sticky, nonplastic; few fine and coarse roots; few fine tubular pores; very few thin clay films on ped faces; slightly acid (pH 6.5); gradual, smooth boundary.

C--34 to 66 inches, light yellowish-brown (10YR 6/4) loamy coarse sand, yellowish brown (10YR 5/4) moist; massive; soft, very friable, nonsticky, nonplastic; few fine and coarse roots; few fine tubular pores; neutral (pH 6.7).

The A horizon ranges from brown to pale brown or yellowish brown in color, from sandy loam to coarse sandy loam in texture, and from 5 to 10 inches in thickness. The B horizon ranges from yellowish brown to light yellowish brown in color, from sandy loam to loam in texture, and from 16 to 32 inches in thickness. The C horizon ranges from light yellowish brown to brownish yellow in color. In places this layer is stratified. It extends to a depth of more than 60 inches.

Included with this soil in mapping are small areas of Visalia soils, Ramona soils, and Tujunga soils.

Fertility is medium. Permeability is moderately rapid. The available water holding capacity is between 5.5 and 7.5 inches. Runoff is slow, and the erosion hazard slight. The rooting depth is more than 60 inches.

This soil is used for improved pasture, dryfarmed grain, avocados, citrus, truck crops, tomatoes, flowers, and stone fruits. Capability unit IIe-1 (19).

Greenfield sandy loam, 0 to 2 percent slopes (GrA).--This soil is nearly level. Runoff is very slow, and the erosion hazard is slight. In other features, this soil is similar to Greenfield sandy loam, 2 to 5 percent slopes.

Included in mapping are small areas of Visalia soils, Ramona soils, and Tujunga soils.

This Greenfield soil is used for avocados, citrus, truck crops, tomatoes, flowers, pasture, and dry-farmed grain. Capability unit IIs-4 (19).

Greenfield sandy loam, 5 to 9 percent slopes (GrC).--This soil is moderately sloping. Runoff is slow to medium, and the erosion hazard slight to moderate. In other features, this soil is similar to Greenfield sandy loam, 2 to 5 percent slopes.

Included in mapping were small areas of Visalia soils, Ramona soils, and Tujunga soils.

This Greenfield soil is used for avocados, citrus, flowers, truck crops, tomatoes, pasture, and dry-farmed grain. Capability unit IIe-1 (19).

Greenfield sandy loam, 9 to 15 percent slopes (GrD).--This soil is strongly sloping. The available water holding capacity is 5.5 to 6.5 inches. Runoff is medium, and the erosion hazard moderate. In other features, this soil is similar to Greenfield sandy loam, 2 to 5 percent slopes.

Included in mapping are small areas of Visalia soils and Ramona soils.

This Greenfield soil is used for avocados, citrus, flowers, pasture, dryfarmed grain, and range. Capability unit IIIe-1 (19); Loamy range site.

Hambright Series

The Hambright series consists of well-drained, shallow gravelly clay loams that formed in material derived from shaly breccia. These soils are in mountainous areas and have slopes of 30 to 75 percent. The elevation ranges from 200 to 1,800 feet. The mean annual precipitation is between 14 and 16 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 300 to 330 days. The winter growing season has only light frost. The vegetation is chiefly chamise and annual grasses and forbs.

In a representative profile the surface layer is brown, slightly acid gravelly clay loam about 8 inches thick. The subsoil is brown, slightly acid gravelly clay loam about 9 inches thick. At a depth of about 17 inches is greenish and bluish shaly breccia.

These soils are used for range.

Hambright gravelly clay loam, 30 to 75 percent slopes (HaG).--This steep to very steep soil is in mountainous areas. The slope averages 45 percent.

Representative profile: NW 1/4 of SE 1/4 sec. 33, T. 10 S., R. 6 W.

A11--0 to 2 inches, brown (10YR 5/3) gravelly light clay loam, dark brown (10YR 3/3) moist; moderate, fine, granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many medium and fine roots; many fine interstitial pores; slightly acid (pH 6.3); 25 percent gravel; abrupt, smooth boundary.

A12--2 to 8 inches, brown (10YR 5/3) gravelly clay loam, dark brown (10YR 3/3) moist; moderate,

fine and medium, subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common medium and fine roots; common fine interstitial pores; slightly acid (pH 6.3); 25 percent gravel; clear, smooth boundary.

B2--8 to 17 inches, brown (7.5YR 5/4) gravelly heavy clay loam, dark brown (7.5YR 4/4) moist; moderate, medium, subangular blocky structure; hard, friable, sticky, plastic; few medium and fine roots; few fine interstitial pores; slightly acid (pH 6.3); 25 percent gravel; clear, wavy boundary.

R--17 inches, greenish and bluish shaly breccia of varying hardness.

The A horizon ranges from pale brown to brown or yellowish brown in color, from gravelly heavy fine sandy loam to clay loam in texture, and from 7 to 11 inches in thickness. The B horizon ranges from brown to yellowish brown in color, from gravelly heavy clay loam to gravelly clay in texture, and from 7 to 10 inches in thickness. Depth to the R horizon ranges from 14 to 20 inches. This soil is 20 to 30 percent gravel. The Hambright soil in this Area has brighter colors, a more clayey subsoil, and fewer coarse fragments throughout the profile than the Hambright soils mapped elsewhere in California.

Included with this soil in mapping are small areas of Elder soils and Gaviota soils. Also included is about 500 acres of strongly sloping to moderately steep Hambright soils.

Fertility is low. Permeability is moderately slow. The available water holding capacity is 2 to 3 inches. Runoff is rapid to very rapid, and the erosion hazard high to very high. The rooting depth is 14 to 20 inches.

This soil is used for range. Capability unit VIIe-7 (19); Shallow Loamy range site.

Holland Series

The Holland series consists of well-drained, moderately deep and deep fine sandy loams that formed in material weathered from micaceous schist. These soils are on mountainous uplands and have slopes of 2 to 60 percent. The elevation ranges from 3,200 to 5,600 feet. The mean annual precipitation is between 20 and 35 inches, and the mean annual air temperature between 53° and 56° F. The frost-free season is 150 to 200 days. The vegetation consists of open stands of Jeffrey pine, Coulter pine, black oak, live oak, incense-cedar, and manzanita, and an understory of shrubs and grasses.

In a representative profile the surface layer is brown and yellowish-brown, medium acid, micaceous fine sandy loam about 20 inches thick. The subsoil is brown, medium acid, micaceous sandy clay loam. This layer extends to a depth of about 35 inches. The substratum is brownish-yellow, highly weathered mica schist. In some areas the soil is stony and cobbly throughout.



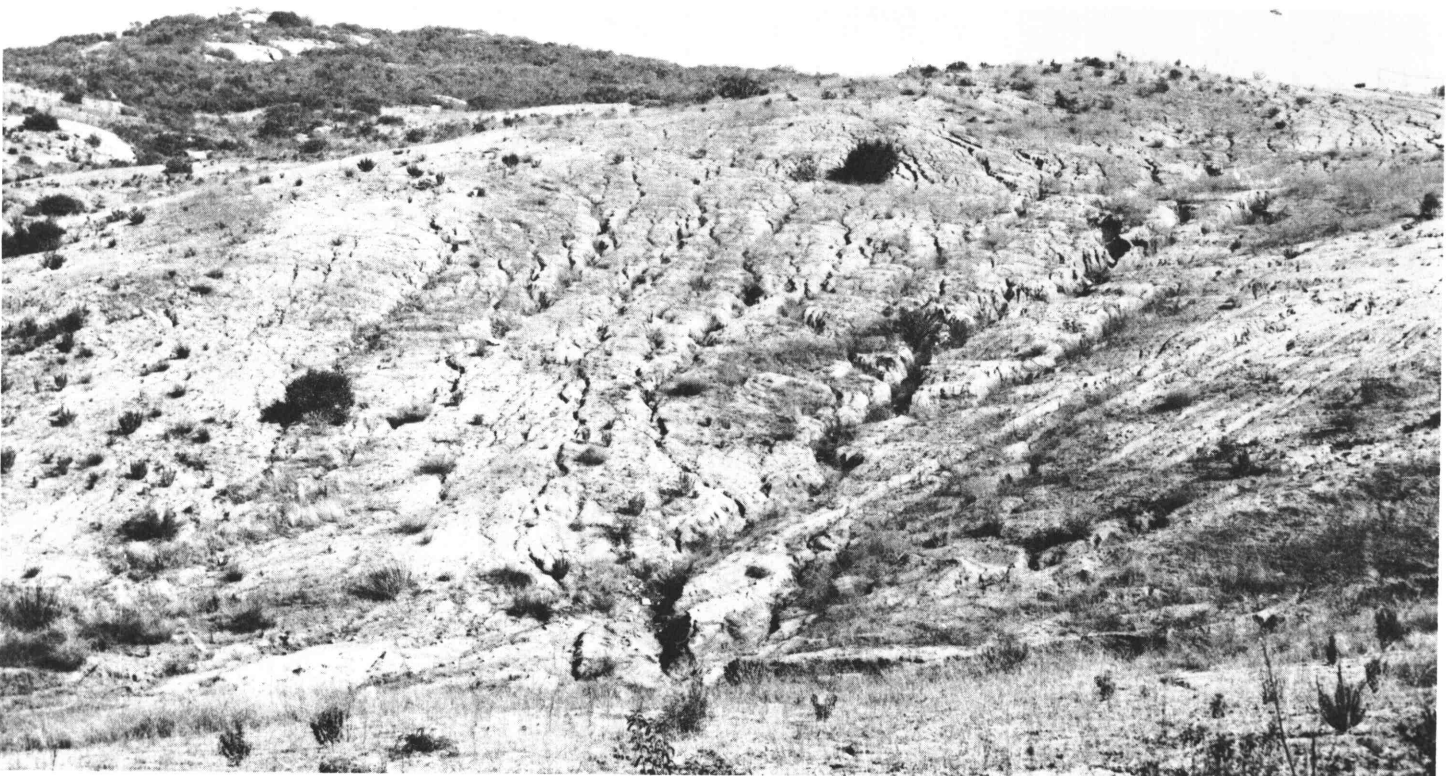
Tomatoes on Altamont clay, 5 to 9 percent slopes.



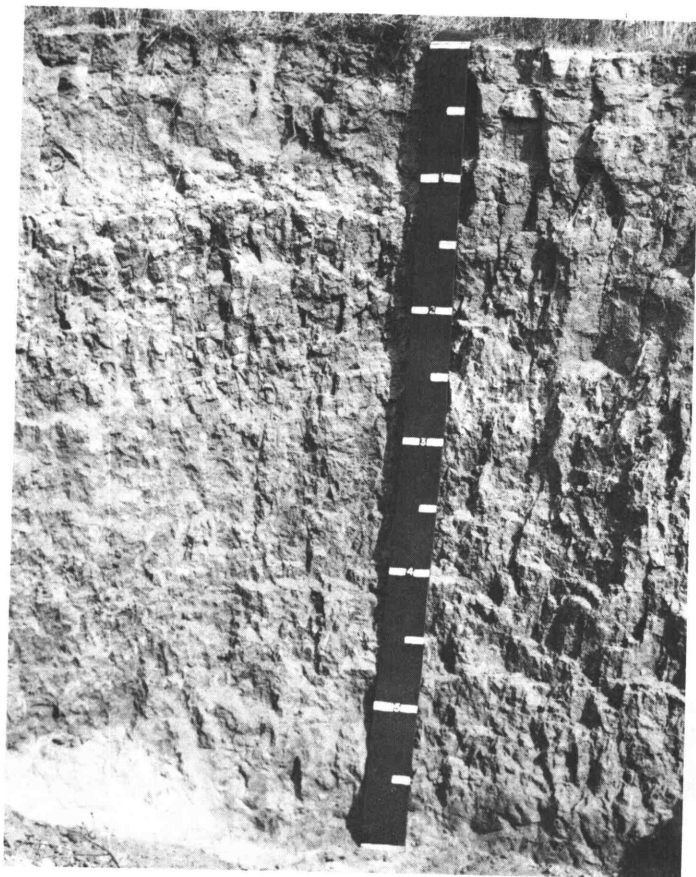
Carrizo very gravelly sand, 0 to 9 percent slopes, in foreground. Rositas fine sand, 0 to 2 percent slopes, in background.



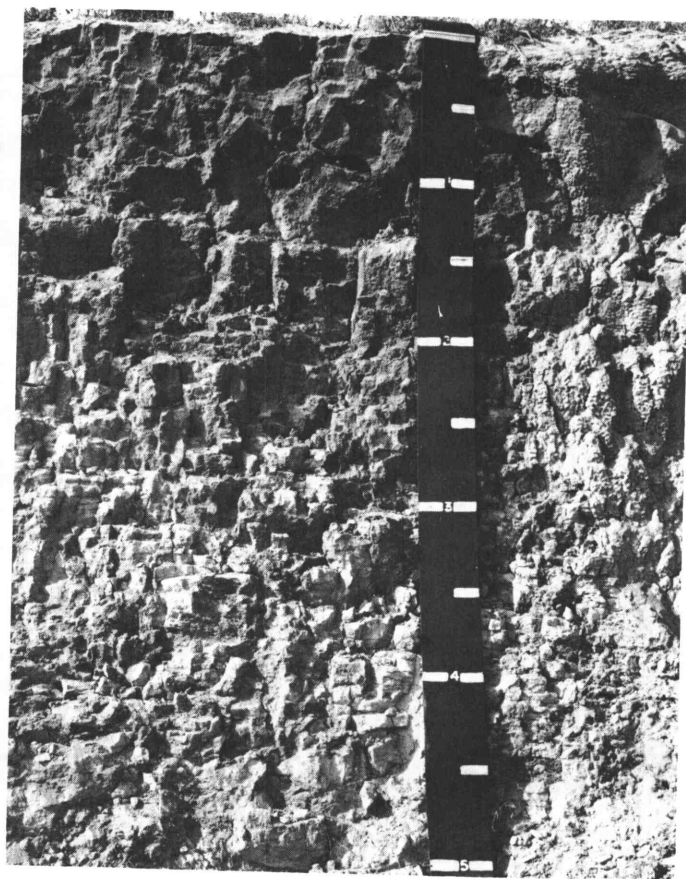
Avocados on Cieneba rocky coarse sandy loam. Young trees in foreground. Mature trees in background.



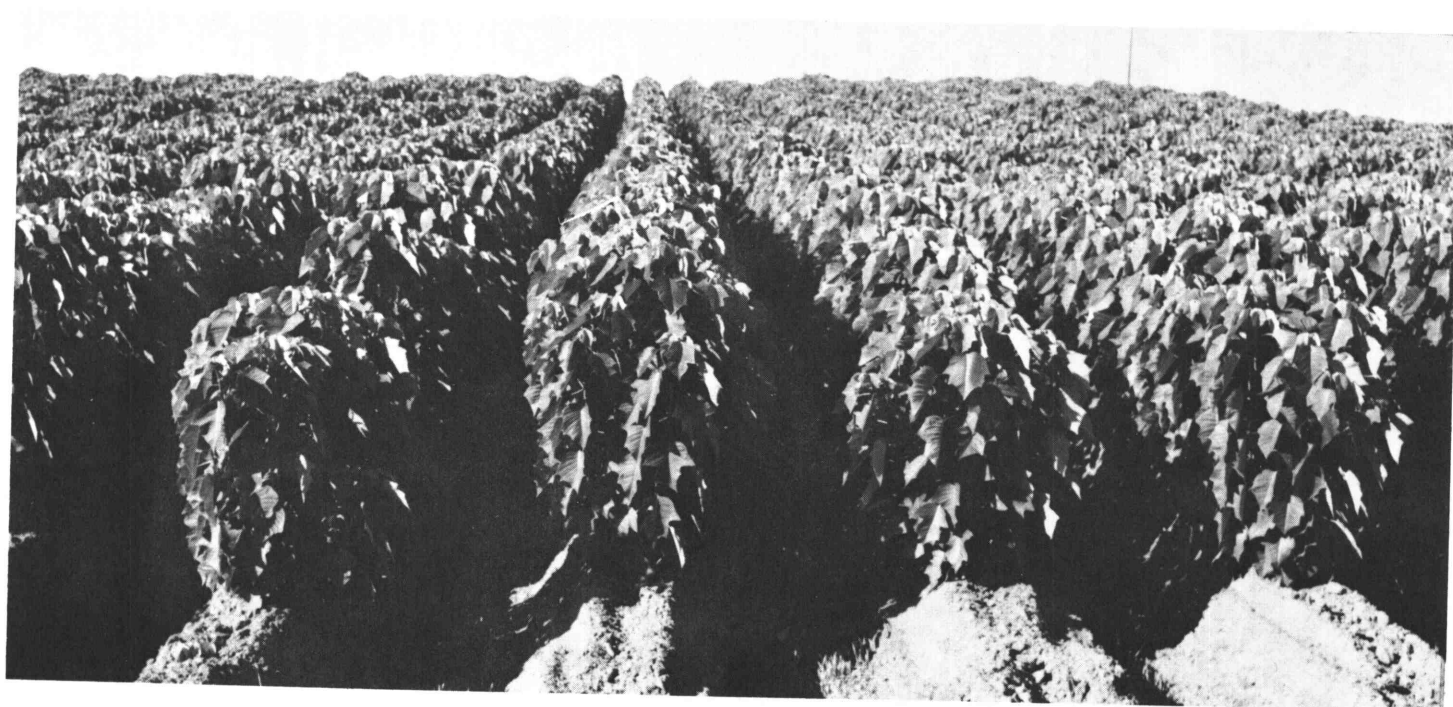
Gullied hillside in area of Fallbrook sandy loam, 9 to 30 percent slopes, severely eroded. Gullies formed after vegetation was removed and no protective cover crop was established.



Profile of Huerhuero loam.



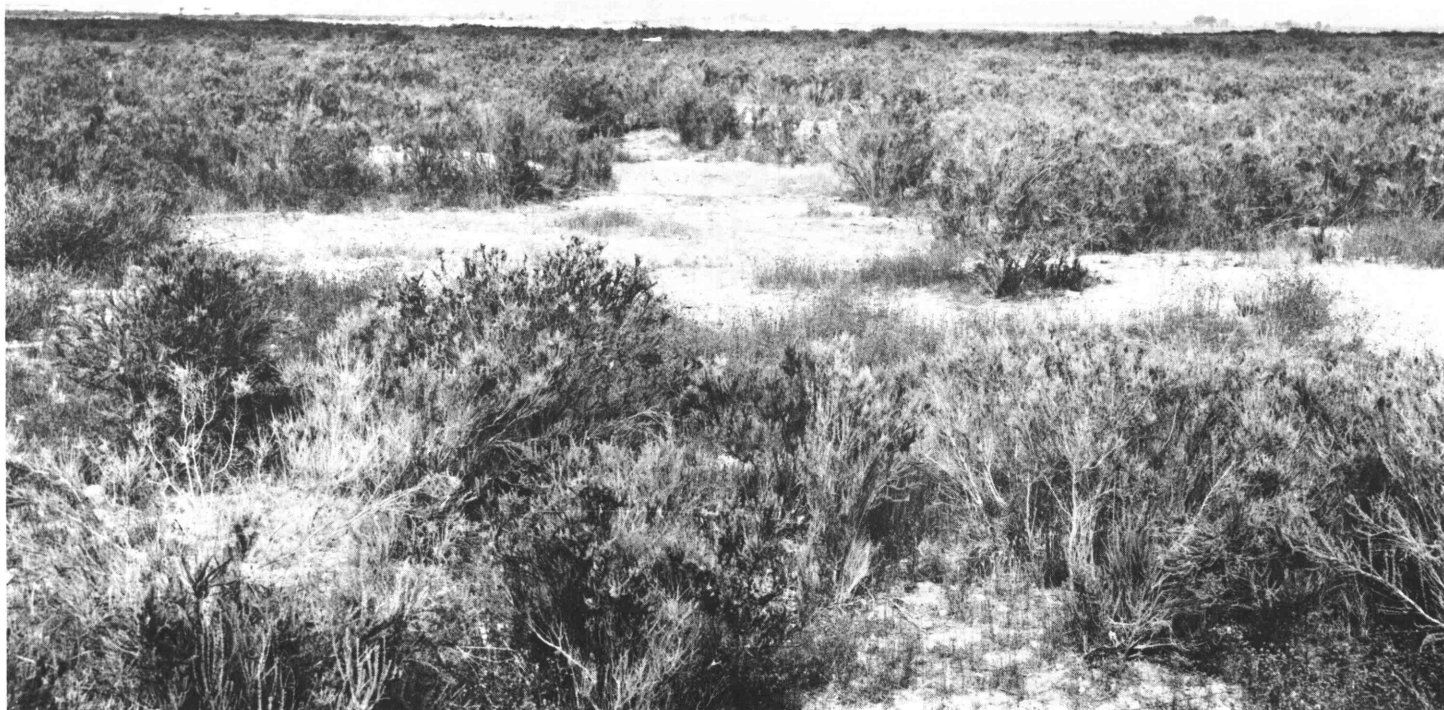
Profile of Las Flores loamy fine sand.



Poinsettias on Marina loamy coarse sand, 2 to 9 percent slopes.



Cut and fill operations and leveling for building sites on Olivenhain-Urban land complex.



Typical landscape of Redding gravelly loam, 2 to 9 percent slopes, on Miramar Mesa.



Profile of Vista coarse sandy loam, showing irregular, broken boundary between B and C horizons.



Young avocado grove on steep Vista soil.

Holland soils are used for apple and pear orchards, range, and recreational areas. Areas that are predominantly woodland are used mostly for summer cottages.

Holland fine sandy loam, 15 to 30 percent slopes (HmE).--This moderately steep soil is on uplands. The slope averages 17 percent.

Representative profile: 700 feet east of Boulder Peak Road, 1,425 feet south-southeast of its junction with Pine Hills Road, SW 1/4 sec. 13, T. 13 S., R. 3 E.

A11--0 to 3 inches, brown (10YR 4/3), micaceous fine sandy loam, dark brown (10YR 3/3) moist; weak, fine, granular structure; soft, very friable, nonsticky, slightly plastic; many very fine random roots; common, very fine, random tubular pores; medium acid (pH 6.0); abrupt, smooth boundary.

A12--3 to 10 inches, yellowish-brown (10YR 5/4), micaceous fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak, medium, sub-angular blocky structure; slightly hard, friable, nonsticky, slightly plastic; common fine random roots; common fine random pores; medium acid (pH 6.0); clear, smooth boundary.

A3--10 to 20 inches, yellowish-brown (10YR 5/4), micaceous fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak, medium, sub-angular blocky structure; slightly hard, friable, nonsticky, slightly plastic; common medium random roots; many, medium, random tubular pores; medium acid (pH 6.0); abrupt, wavy boundary.

B21t--20 to 29 inches, brown (7.5YR 5/4), micaceous sandy clay loam, brown (7.5YR 4/4) moist; strong, coarse, angular blocky structure; hard, firm, slightly sticky, plastic; few medium and coarse random roots; many moderately thick clay films on ped faces; medium acid (pH 5.8); clear, wavy boundary.

B22t--29 to 35 inches, brown (7.5YR 5/4), micaceous sandy clay loam, brown (7.5YR 4/4) moist; strong, coarse, angular blocky structure; hard, firm, sticky, very plastic; few medium and coarse random roots; many, medium, random tubular pores; many thick clay films on ped faces; medium acid (pH 6.0); clear, irregular boundary.

C1--35 to 50 inches, brownish-yellow (10YR 6/6), highly weathered micaceous schist, yellowish brown (10YR 5/4) moist; few medium random roots; medium acid (pH 6.0); gradual, irregular boundary.

C2--50 inches, light-gray (2.5Y 7/2), deeply weathered, highly micaceous schist, dark yellowish brown (10YR 4/4) on cleavage planes, light brownish gray (2.5Y 6/2) moist; few random roots; medium acid (pH 6.0).

The A horizon ranges from brown to dark brown or yellowish brown to dark grayish brown in color,

from micaceous silt loam to micaceous fine sandy loam in texture, and from 13 to 30 inches in thickness. The B horizon ranges from brown and strong brown or reddish brown in color, from micaceous clay loam to sandy clay loam in texture, and from 10 to 20 inches in thickness. The C horizon ranges from brownish yellow to light gray in color. The depth to micaceous schist ranges from 23 to 50 inches.

Included with this soil in mapping are small areas of Crouch soils, Boomer soils, and Sheephead soils.

Fertility is high. Permeability is moderately slow, and the available water holding capacity is 3 to 7 inches. Runoff is medium to rapid. The erosion hazard is moderate to high on unprotected slopes. The rooting depth is 23 to 50 inches.

This soil is used mostly for apple and pear orchards and for range. Small scattered areas are used for summer cottages and for recreational areas. A small amount of oak cordwood is harvested. Capability unit VIe-1 (20); Loamy range site.

Holland fine sandy loam, 5 to 15 percent slopes (HmD).--This soil is moderately sloping to strongly sloping and is 23 to 50 inches deep over schist. Runoff is slow to medium, and the erosion hazard slight to moderate. In other features, this soil is similar to Holland fine sandy loam, 15 to 30 percent slopes.

Included in mapping are small areas of Crouch soils, Boomer soils, and Sheephead soils.

This Holland soil is used for apple and pear orchards, range, and recreational areas. It is not suitable for lumber production, but some oak cordwood is harvested. Capability unit IVE-1 (20); Loamy range site.

Holland stony fine sandy loam, 5 to 30 percent slopes (HnE).--This soil is moderately sloping to moderately steep, is 20 to 36 inches deep over schist, and is 20 to 25 percent stones and cobblestones. Fertility is medium. The available water holding capacity is 2.5 to 4 inches. Runoff is medium, and the erosion hazard moderate. In other features, this soil is similar to Holland fine sandy loam, 15 to 30 percent slopes.

Included in mapping are small areas of Crouch soils, Boomer soils, and Sheephead soils. Also included are areas where the soil is only 15 inches deep over rock.

This Holland soil is used mainly for range, recreational areas, and wildlife habitat. A few selected sites are used for apple and pear orchards. Some oak cordwood is cut from old or dead trees. Capability unit VIe-7 (20); Loamy range site.

Holland stony fine sandy loam, 30 to 60 percent slopes (HnG).--This soil is steep to very steep, is 20 to 32 inches deep over schist, and is 20 to 25 percent stones and cobblestones. Fertility is medium. The available water holding capacity is 2.5 to 3 inches. Runoff is rapid to very rapid, and the erosion hazard high to very high. In other features,

this soil is similar to Holland fine sandy loam, 15 to 30 percent slopes.

Included in mapping are small areas of Crouch soils, Boomer soils, and Sheephead soils. Also included are areas where the soil is only 10 inches deep over rock.

This Holland soil is used for range, recreational areas, and wildlife habitat. Some oak is cut from old or dead trees. Capability unit VIIe-7 (20); Loamy range site.

Holland fine sandy loam, deep, 2 to 9 percent slopes (HoC).--This soil is gently sloping to moderately sloping and is 40 to 64 inches deep over schist. The available water holding capacity is 6 to 9 inches. Runoff is slow to medium, and the erosion hazard slight to moderate. In other features, this soil is similar to Holland fine sandy loam, 15 to 30 percent slopes.

Included in mapping are small areas of Crouch soils and Boomer soils.

This Holland soil is used mainly for pear and apple orchards and for range. Scattered areas are used for recreational areas and summer cottages. A small amount of oak cordwood is harvested. Capability unit IIIe-1 (20); Loamy range site.

Huerhuero Series

The Huerhuero series consists of moderately well drained loams that have a clay subsoil. These soils developed in sandy marine sediments. They have slopes of 2 to 30 percent. The elevation ranges from 10 to 400 feet. The mean annual precipitation is between 10 and 12 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 300 to 350 days. The winter growing season has only light frost. The vegetation in uncultivated areas is mainly tarweed, wild oats, star-thistle, red brome, Russian-thistle, and annual grasses and forbs.

In a representative profile the surface layer is brown and pale-brown, strongly acid and medium acid loam about 12 inches thick. The upper part of the subsoil is brown, moderately alkaline clay. It extends to a depth of about 41 inches. Below this, and extending to a depth of more than 60 inches, is brown, mildly alkaline clay loam and sandy loam (pl. III).

Huerhuero soils are used mainly for range, truck crops, tomatoes, and flowers. Small acreages are used for housing developments.

Huerhuero loam, 2 to 9 percent slopes (HrC).--This soil is gently sloping and undulating. Low broad-based hummocks, locally called mimamounds, occur in undisturbed areas. The slope is dominantly 2 to 5 percent.

Representative profile: 1,230 feet east, 2,020 feet south of northwest corner of sec. 32, T. 10 S., R. 5 W.

A1--0 to 8 inches, brown (10YR 5/3) loam, dark grayish brown (10YR 4/2) moist; massive; hard,

friable, slightly sticky, slightly plastic; common very fine and fine roots, few coarse roots; many fine tubular and interstitial pores; strongly acid (pH 5.3); abrupt, smooth boundary.

A2--8 to 12 inches, pale-brown (10YR 6/3) loam, brown (10YR 5/3) moist; massive; hard, friable, slightly sticky, slightly plastic; few very fine and coarse roots; common fine tubular pores; medium acid (pH 5.7); abrupt, smooth boundary.

B2lt--12 to 19 inches, brown (10YR 4/3) clay, brown (10YR 4/3) moist; strong, medium and coarse, prismatic structure breaking to strong, medium, angular blocky; extremely hard, firm, sticky, plastic; few very fine and coarse roots; many very fine and medium tubular pores; many thick clay films on ped faces; moderately alkaline (pH 8.0); few slickensides; clear, smooth boundary.

B22t--19 to 32 inches, brown (7.5YR 4/4) clay, brown (7.5YR 4/4) moist; strong, medium, prismatic structure breaking to strong, medium and fine, angular blocky; extremely hard, firm, sticky, plastic; few very fine and fine roots, very few coarse roots; many very fine and medium tubular pores; many moderately thick clay films on ped faces; common lime mottles; slightly to strongly effervescent, moderately alkaline (pH 8.2); few slickensides; clear, smooth boundary.

B23t--32 to 41 inches, brown (7.5YR 4/2) clay, brown (7.5YR 4/2) moist; moderate, medium, prismatic structure breaking to moderate, medium and fine, angular blocky; extremely hard, firm, sticky, plastic; few very fine and fine roots; many very fine and medium tubular pores; many moderately thick clay films on ped faces; moderately alkaline (pH 8.0); clear, smooth boundary.

B24t--41 to 55 inches, brown (7.5YR 4/2) clay loam, brown (7.5YR 4/2) moist; moderate, medium and fine, angular blocky structure; hard, friable, sticky, plastic; few very fine roots; common very fine and medium tubular pores; common moderately thick clay films and black manganese stains on ped faces; mildly alkaline (pH 7.8); clear, smooth boundary.

B3--55 to 68 inches, brown (10YR 6/3) sandy loam, brown (10YR 4/3) moist; weak, medium, sub-angular blocky structure; hard, friable, slightly sticky, slightly plastic; few very fine roots; mildly alkaline (pH 7.5); clear, smooth boundary.

C--68 to 72 inches, yellowish-brown (10YR 5/4) loamy sand, dark yellowish brown (10YR 4/4) moist; massive; neutral (pH 7.0); sandy marine sediments.

The A horizon ranges from pale brown or strong brown to yellowish brown or grayish brown in color, from sandy loam to loam in texture, and from 5 to 30 inches in thickness. The B horizon ranges from brown to dark brown or strong brown, yellowish

brown, or reddish brown in color, from clay to heavy clay loam that grades to sandy loam in the lower layers, and from 45 to 67 inches in thickness. The lower part of this horizon typically contains lime mottles. The C horizon is stratified sand to loamy sand. The depth to the C horizon ranges from 50 to 72 inches.

Included with this soil in mapping are small areas of Las Flores soils, Stockpen soils, and Olivenhain soils. Also included are areas of alluvium derived from metabasic and metasedimentary rock; areas of alluvium, near Twin Oaks Valley and Harmony Grove, that range from loam to silt loam in texture; and small areas of Loamy alluvial land-Huerhuero complex.

Fertility is low to medium. Permeability is very slow. The available water holding capacity is 4 to 5.5 inches; some moisture is available from the clay subsoil. Runoff is slow to medium, and the erosion hazard slight to moderate. The rooting depth is 20 to 43 inches.

This soil is used mainly for range, irrigated truck crops, tomatoes, and flowers. Small acreages are used for housing developments. Capability unit IIIe-3 (19); Claypan range site.

Huerhuero loam, 5 to 9 percent slopes, eroded (HrC2).--This soil is moderately sloping and, because of moderate sheet erosion, has an effective rooting depth of 20 to 40 inches. The available water holding capacity is 4 to 5 inches. In other features, this soil is similar to Huerhuero loam, 5 to 9 percent slopes.

Included in mapping are small areas of Las Flores soils and Olivenhain soils. Also included are areas of alluvium derived from metabasic and metasedimentary rocks.

This Huerhuero soil is used for truck crops, tomatoes, flowers, range, and housing developments. Capability unit IVe-3 (19); Claypan range site.

Huerhuero loam, 9 to 15 percent slopes (HrD).--This soil is strongly sloping and has an effective rooting depth of 20 to 40 inches. The available water holding capacity is 3.5 to 5.5 inches. Runoff is medium, and the erosion hazard moderate. In other features, this soil is similar to Huerhuero loam, 5 to 9 percent slopes.

Included in mapping are small areas of Las Flores soils and Olivenhain soils. Also included are areas adjacent to rocky and gravelly ridges where the surface layer contains gravel and cobblestones.

This Huerhuero soil is used for tomatoes, flowers, range, and housing developments. Capability unit IVe-3 (19); Claypan range site.

Huerhuero loam, 9 to 15 percent slopes, eroded (HrD2).--This soil is strongly sloping and, because of moderate sheet erosion, has an effective rooting depth of 20 to 40 inches. The available water holding capacity is 3.5 to 5 inches. Runoff is medium, and the erosion hazard moderate. In other features, this soil is similar to Huerhuero loam, 5 to 9 percent slopes.

Included in mapping are small areas of Las Flores soils and Olivenhain soils. Also included are areas adjacent to rocky and gravelly ridges where the surface layer contains gravel and cobblestones.

This Huerhuero soil is used for tomatoes, flowers, range, and housing developments. Capability unit IVe-3 (19); Claypan range site.

Huerhuero loam, 15 to 30 percent slopes, eroded (HrE2).--This soil is moderately steep and, because of moderate sheet and rill erosion, has an effective rooting depth of 20 to 36 inches. The available water holding capacity is 3.5 to 4.5 inches. Runoff is medium to rapid, and the erosion hazard moderate to high. In other features, this soil is similar to Huerhuero loam, 5 to 9 percent slopes.

Included in mapping are small areas of Las Flores soils, Olivenhain soils, and Loamy alluvial land-Huerhuero complex.

This Huerhuero soil is used for range. Capability unit VIe-3 (19); Claypan range site.

Huerhuero-Urban land complex, 2 to 9 percent slopes (HuC).--This complex occurs on marine terraces, at elevations that range from sea level to 400 feet. The landscape has been altered through cut and fill operations and leveling for building sites. Before cut and fill operations and leveling, the slope was 2 to 9 percent.

The material exposed in the cuts consists of unconsolidated sandy marine sediments. The material in the fills is a mixture of loam and clay loam and sandy marine sediments. Cuts and fills should be determined by onsite investigation. Between the leveled building lots are moderately steep escarpments that are easily eroded.

The entire acreage is used for homesites.

Huerhuero-Urban land complex, 9 to 30 percent slopes (HuE).--This complex occurs on marine terraces, at elevations that range from sea level to 400 feet. The landscape has been altered through cut and fill operations and leveling for building sites. Before cut and fill operations and leveling, the slope gradient was 9 to 30 percent.

The material exposed in the cuts consists of unconsolidated sandy marine sediments. The material in the fills is a mixture of loam and clay and sandy marine sediments. Cuts and fills should be determined by onsite investigation. Between the leveled building lots are very steep escarpments that are easily eroded.

The entire acreage is used for homesites.

Indio Series

The Indio series consists of well drained and moderately well drained, very deep silt loams that formed in alluvium derived from acid, igneous and micaceous rocks. These soils are on alluvial fans and alluvial plains and have slopes of 0 to 5 percent. The elevation ranges from 100 to 500 feet. The mean annual precipitation is between 3 and 8

inches, and the mean annual air temperature between 70° and 74° F. The frost-free season is 260 to 275 days. The vegetation in uncultivated areas is mainly bur-sage, mesquite, creosotebush, and a few annual grasses and forbs.

In a representative profile the surface layer is pale-brown, moderately alkaline, calcareous silt loam about 6 inches thick. The next layer also is pale-brown, moderately alkaline, calcareous silt loam. It extends to a depth of about 45 inches. Below this, to a depth of more than 60 inches, is fine sandy loam.

Indio soils are used mainly for dates, cotton, and alfalfa. A few areas are used as vineyards.

Indio silt loam, 0 to 2 percent slopes (InA).--This nearly level soil is on alluvial plains. The slope averages 1 percent.

Representative profile: 2,500 feet west, 1,750 feet south of northeast corner of sec. 9, T. 14 S., R. 6 E.

- C1--0 to 6 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak, medium, platy structure; slightly hard, very friable, non-sticky, nonplastic; common fine and medium roots; common very fine and fine tubular and interstitial pores; slightly effervescent, moderately alkaline (pH 8.0); clear, smooth boundary.
- C2--6 to 45 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky, nonplastic; few fine roots, common medium roots; very few fine tubular pores, common very fine and fine interstitial pores; slightly effervescent, moderately alkaline (pH 8.1); clear, smooth boundary.
- C3--45 to 60 inches, pale-brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky, nonplastic; very few fine roots; very few fine tubular pores, common very fine and fine interstitial pores; slightly effervescent, moderately alkaline (pH 8.2).

The C1 horizon, or the surface layer, ranges from pale brown to light brownish gray in color, from silt loam to very fine sandy loam in texture, and from 4 to 9 inches in thickness. The C2 and C3 horizons range from pale brown to light brownish gray or brown in color and from silt loam to fine sandy loam in texture. The C3 horizon extends to a depth of more than 60 inches. In many places the profile is stratified fine sandy loam and very fine sandy loam.

Included with this soil in mapping are small areas of Mecca soils, Rositas soils, and Carrizo soils.

Drainage is good. Fertility is high. Permeability is moderate. The available water holding capacity is 7.5 to 9.5 inches. Runoff is very slow, and the erosion hazard none to slight. The rooting depth is more than 60 inches.

This soil is used mainly for cotton, dates, and alfalfa. A few small areas are used as grape vineyards. Capability unit I-1 (30).

Indio silt loam, 2 to 5 percent slopes (InB).--This soil is gently sloping. Runoff is slow, and the erosion hazard is slight. In other features, this soil is similar to Indio silt loam, 0 to 2 percent slopes.

Included in mapping are small areas of Mecca soils, Rositas soils, and Carrizo soils.

This Indio soil is used for alfalfa and cotton. Capability unit IIE-1 (30).

Indio silt loam, saline, 0 to 2 percent slopes (IoA).--This soil is moderately saline. Drainage is moderately good. Runoff is very slow, and the erosion hazard is none to slight. In other features, this soil is similar to Indio silt loam, 0 to 2 percent slopes.

Included in mapping are small areas of Mecca soils, Rositas soils, and Carrizo soils.

This Indio soil is used for range and pasture. Capability unit IIIs-6 (30); Alkali Flats range site.

Indio Series, Dark Variant

The Indio series, dark variant, consists of well-drained, very deep silt loams that formed in alluvium derived from acid basic igneous rocks, igneous rocks, and micaceous schist. These soils are on alluvial fans and alluvial plains and have slopes of 0 to 2 percent. The elevation ranges from 1,500 to 2,500 feet. The mean annual precipitation is between 5 and 7 inches, and the mean annual air temperature between 64° and 66° F. The frost-free season is 220 to 250 days. The vegetation in uncultivated areas is mainly bur-sage and annual grasses and forbs.

In a representative profile the surface layer is grayish-brown, moderately alkaline, slightly effervescent silt loam about 10 inches thick. The next layers are grayish-brown and light brownish-gray, moderately alkaline, strongly effervescent silt loams.

Indio soils, dark variant, are used for pasture and crops.

Indio silt loam, dark variant (IsA).--This nearly level soil is on alluvial fans and alluvial plains. The slope averages 1 percent.

Representative profile: 600 feet northeast of southwest corner, SW 1/4 of SW 1/4 sec. 19, T. 12 S., R. 5 E. (Projected).

- A1--0 to 11 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak, fine, subangular blocky and fine, medium, granular structure; slightly hard, friable, nonsticky, nonplastic; plentiful very fine and fine roots; common very fine and fine tubular pores; slightly effervescent, moderately alkaline (pH 7.9); clear, smooth boundary.

C1--11 to 30 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, friable, non-sticky, nonplastic; few very fine roots; few very fine and medium tubular pores; disseminated lime; slightly to strongly effervescent, moderately alkaline (pH 8.1); gradual, smooth boundary.

C2--30 to 62 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable, non-sticky, nonplastic; very few very fine roots; very few fine and medium tubular pores; strongly effervescent, moderately alkaline (pH 8.2).

The A horizon ranges from 8 to 13 inches in thickness. The C horizon ranges from grayish brown and light brownish gray in color and from silt loam to loam in texture. This horizon extends to a depth of more than 60 inches.

Included with this soil in mapping are small areas of Mecca soils and Rositas soils.

Fertility is high. Permeability is moderate. The available water holding capacity is 7.5 to 9.5 inches. Runoff is very slow, and the erosion hazard none to slight. The rooting depth is more than 60 inches.

This soil is used mainly for irrigated pasture. Occasionally, truck crops are grown commercially. Capability unit I-1 (30).

Kitchen Creek Series

The Kitchen Creek series consists of somewhat excessively drained, deep to moderately deep loamy coarse sands. These soils formed in material derived from granodiorite. They are on smooth broad ridges and have slopes of 5 to 15 percent. The elevation ranges from 2,500 to 4,500 feet. The mean annual precipitation is between 12 and 18 inches, and the mean annual air temperature between 56° and 58° F. The frost-free season is 160 to 185 days. The vegetation is mainly chamise, scrub oak, mountain-mahogany, flatter buckwheat, and annual grasses.

In a representative profile the surface layer is dark-brown and brown, slightly acid loamy coarse sand about 21 inches thick. The subsoil is light brownish-gray, pale-brown, and very pale brown, slightly acid and medium acid coarse sandy loam about 33 inches thick. Below this is deeply weathered granodiorite.

Kitchen Creek soils are used for range and wildlife habitat.

Kitchen Creek loamy coarse sand, 5 to 9 percent slopes (KcC).--This gently rolling soil is on very broad ridges. The slope averages 6 percent.

Representative profile: 800 feet southwest of east quarter corner of sec. 3, T. 17 S., R. 6 E.

A11--0 to 4 inches, dark-brown (10YR 3/3), micaceous loamy coarse sand, very dark brown (10YR 2/2) moist; weak, fine, granular structure; soft, very friable, nonsticky, nonplastic; many very fine vertical roots; many very fine interstitial pores; slightly acid (pH 6.5); clear, smooth boundary.

A12--4 to 12 inches, dark-brown (10YR 3/3) loamy coarse sand, very dark brown (10YR 2/2) moist; massive; soft, very friable, nonsticky, nonplastic; common fine random roots; slightly acid (pH 6.5); gradual, smooth boundary.

A13--12 to 21 inches, brown (10YR 4/3) loamy coarse sand, dark brown (10YR 3/3) moist; massive; slightly hard, friable, nonsticky, nonplastic; few fine random roots; slightly acid (pH 6.5); clear, smooth boundary.

B1--21 to 28 inches, light brownish-gray (10YR 6/2) coarse sandy loam, brown (10YR 5/3) moist; massive; hard, friable, nonsticky, slightly plastic; few fine random roots; common fine random pores; colloids in bridges between mineral grains; slightly acid (pH 6.5); clear, wavy boundary.

B2t--28 to 42 inches, pale-brown (10YR 6/3) coarse sandy loam, yellowish brown (10YR 5/4) moist; weak, coarse, angular blocky structure and massive; very hard, firm, sticky, plastic; few fine random roots; common fine random pores; colloid in bridges between mineral grains; medium acid (pH 6.0); gradual, smooth boundary.

B3t--42 to 54 inches, very pale brown (10YR 7/3) coarse sandy loam, pale brown (10YR 6/3) moist; massive; hard, friable, nonsticky, slightly plastic; few fine random roots; few fine tubular pores; colloid in bridges between mineral grains; medium acid (pH 6.0); gradual, smooth boundary.

C--54 inches, white (10YR 8/2) decomposed granitic rock containing very dark gray (10YR 3/1) mica crystals and very dark grayish-brown (10YR 3/2) stains of decaying roots, very pale brown (10YR 7/4) and light yellowish brown (10YR 6/4) moist; few fine random roots; medium acid (pH 6.0).

The A horizon ranges from dark brown to brown or very dark grayish brown in color, from loamy coarse sand to coarse sandy loam in texture, and from 13 to 30 inches in thickness. The B horizon ranges from pale brown to light brownish gray or very pale brown in color, from coarse sandy loam to sandy loam in texture, and from 24 to 44 inches in thickness. The depth to decomposed granodiorite commonly ranges from 37 to 60 inches.

Included with this soil in mapping are small areas of Mottsville soils, La Posta soils, and Cal-pine soils.

Fertility is low. Permeability is moderately rapid. The available water holding capacity is 3 to 5.5 inches. Runoff is slow to medium, and the

erosion hazard slight to moderate. The rooting depth is 37 to 60 inches.

This soil is used for range and wildlife habitat. Capability unit IVec-4 (20); Sandy range site.

Kitchen Creek loamy coarse sand, 9 to 15 percent slopes, eroded (KcD2).--This soil is strongly sloping and is 36 to 57 inches deep over decomposed granitic rock. Rill and gully erosion have been moderate. Runoff is medium, and the erosion hazard moderate. In other features, this soil is similar to Kitchen Creek loamy coarse sand, 5 to 9 percent slopes.

Included in mapping are small areas of Mottsville soils, La Posta soils, and Calpine soils. Also included are a few large rock outcrops.

This Kitchen Creek soil is used for range and wildlife habitat. Capability unit IVec-4 (20); Sandy range site.

La Posta Series

The La Posta series consists of somewhat excessively drained loamy coarse sands that formed in material weathered from granodiorite. These soils are on mountainous uplands and have slopes of 5 to 50 percent. The elevation ranges from 2,000 to 4,500 feet. The mean annual precipitation is between 15 and 20 inches, and the mean annual air temperature between 56° and 58° F. The frost-free season is 170 to 190 days. The vegetation in uncultivated areas is mainly chamise, ceanothus, sumac, scrub oak, red shank, and annual grasses. A few scattered oaks occur on north-facing slopes and along drainageways.

In a representative profile the surface layer is grayish-brown and brown, slightly acid and neutral loamy coarse sand about 10 inches thick. The next layer is brown, slightly acid loamy coarse sand that grades to deeply weathered granodiorite at a depth of about 29 inches. In some areas rock outcrop covers 5 to 10 percent of the surface.

La Posta soils are used for range, watershed, and wildlife habitat.

La Posta loamy coarse sand, 5 to 30 percent slopes, eroded (LaE2).--This gently rolling to hilly soil is on strongly dissected plateaus and terraces. The slope averages 6 percent.

Representative profile: 4,650 feet south, 450 feet west of northeast corner, SE 1/4 of SE 1/4 sec. 23, T. 11 S., R. 4 E.

A11--0 to 2 inches, grayish-brown (10YR 5/2) loamy coarse sand, very dark grayish brown (10YR 3/2) moist; weak, very fine, granular structure; soft, very friable, nonsticky, nonplastic; many very fine random roots; many very fine interstitial pores; slightly acid (pH 6.5); clear, smooth boundary.

A12--2 to 7 inches, grayish-brown (10YR 5/2) loamy coarse sand, very dark grayish brown (10YR 3/2) moist; weak, fine, granular structure;

soft, friable, nonsticky, nonplastic; many fine random roots; many very fine interstitial pores; neutral (pH 7.2); clear, wavy boundary. Tongues of this horizon penetrate the underlying material.

A13--7 to 10 inches, brown (10YR 5/3) loamy coarse sand, dark brown (10YR 3/3) moist; massive; slightly hard, friable, nonsticky, nonplastic; common fine to medium random roots; many very fine interstitial pores; neutral (pH 7.2); clear, wavy boundary.

C1--10 to 29 inches, brown (10YR 5/3) loamy coarse sand breaking from highly weathered granodiorite, dark brown (10YR 4/3) moist; massive; hard, friable, nonsticky, nonplastic; few medium to coarse random roots; common, fine, random tubular pores; few thin clay films in pores and on mineral grains; slightly acid (pH 6.5); diffuse, smooth boundary.

C2--29 inches, brown (10YR 5/3) weathered granodiorite; dark brown (10YR 4/3) moist; few medium and coarse random roots; medium acid (pH 6.0).

The A horizon ranges from grayish brown to brown in color, from loamy coarse sand to loamy sand in texture, and from 10 to 19 inches in thickness. The C1 horizon ranges from brown to pale brown or light brownish gray in color, from loamy coarse sand to loamy sand in texture, and from 15 to 22 inches in thickness. The C2 horizon is loamy weathered granodiorite. It ranges from brown to very pale brown in color.

Included with this soil in mapping are small areas of Kitchen Creek soils and Tollhouse soils. Also included are areas of rock outcrop and a few small areas of severely eroded soils.

Fertility is low. Permeability is rapid. The available water holding capacity is 2 to 3 inches. Runoff is medium, and the erosion hazard moderate. Rill and gully erosion have been moderate. The rooting depth is 25 to 32 inches.

This soil is used for wildlife habitat and watershed. A limited acreage is in range. Capability unit VIsc-4 (20); Granitic range site.

La Posta loamy coarse sand, 5 to 30 percent slopes, severely eroded (LaE3).--This soil is moderately sloping to moderately steep and is 16 to 27 inches deep over weathered granodiorite. More than 75 percent of the surface layer has been removed by rill and gully erosion, and the subsoil is exposed in 25 percent of the area. The available water holding capacity is 1 inch to 2 inches. Runoff is medium, and the erosion hazard is moderate to high. In other features, this soil is similar to La Posta loamy coarse sand, 5 to 30 percent slopes, eroded.

Included in mapping are small areas of Kitchen Creek soils, Tollhouse soils, and rock outcrop.

This La Posta soil is used for range and watershed. Capability unit VIIe-1 (20); Granitic range site.

La Posta rocky loamy coarse sand, 5 to 30 percent slopes (LcE).--This soil is moderately sloping to

moderately steep, is not eroded, and is 16 to 32 inches deep over weathered granodiorite. Rock outcrop covers 5 to 10 percent of the surface. The available water holding capacity is 1 inch to 2.5 inches. Runoff is medium, and the erosion hazard moderate. In other features, this soil is similar to La Posta loamy coarse sand, 5 to 30 percent slopes, eroded.

Included in mapping are small areas of Kitchen Creek soils and Tollhouse soils.

This La Posta soil is used for range and watershed. Capability unit VIIe-7 (20); Granitic range site.

La Posta rocky loamy coarse sand, 5 to 30 percent slopes, eroded (LcE2).--This soil is moderately sloping to moderately steep and is 16 to 30 inches deep over weathered granodiorite. Rill and gully erosion have been moderate. Rock outcrop covers 5 to 10 percent of the surface. The available water holding capacity is 1 inch to 2 inches. Runoff is medium, and the erosion hazard moderate. In other features, this soil is similar to La Posta loamy coarse sand, 5 to 30 percent slopes, eroded.

This La Posta soil is used for range and watershed. Capability unit VIIe-7 (20); Granitic range site.

La Posta rocky loamy coarse sand, 30 to 50 percent slopes, eroded (LcF2).--This soil is steep and is 16 to 26 inches deep over weathered granodiorite. Rill and gully erosion have been moderate. Rock outcrop covers 5 to 10 percent of the surface. The available water holding capacity is 1 inch to 2 inches. Runoff is rapid, and the erosion hazard high. In other features, this soil is similar to La Posta loamy coarse sand, 5 to 30 percent slopes, eroded.

Included in mapping are small areas of Kitchen Creek soils, Tollhouse soils, and severely eroded soils.

This La Posta soil is used mainly for watershed and wildlife habitat. A limited acreage is used for range. Capability unit VIIe-7 (20); Granitic range site.

La Posta-Sheephead complex, 9 to 30 percent slopes (LdE).--This unit is about 50 percent La Posta loamy coarse sand and 40 percent Sheephead cobbly fine sandy loam. It occurs on uplands, at elevations of 2,500 to 5,000 feet. Rock outcrop covers about 10 percent of the surface.

Included in mapping are small areas of Kitchen Creek soils and Tollhouse soils.

The La Posta soil has a surface layer of brown loamy coarse sand about 10 inches thick. The next layer is brown loamy coarse sand that grades to weathered granitic rock at a depth of about 29 inches. Detailed information is given in the description of La Posta loamy coarse sand, 5 to 30 percent slopes, eroded.

The Sheephead soil has a surface layer of brown cobbly fine sandy loam about 8 inches thick. The next layer is light yellowish-brown stony fine sandy loam that grades to micaceous schist at a depth of about 51 inches. Detailed information about this

soil is given in the description of Sheephead rocky fine sandy loam, 30 to 65 percent slopes, eroded, under the heading "Sheephead Series."

La Posta loamy coarse sand is somewhat excessively drained, is rapidly permeable in the subsoil, and has 1 inch to 2.5 inches of water available in the 16 to 32 inches of effective rooting depth.

Sheephead cobbly fine sandy loam is well drained, is moderately rapidly permeable, and has 1 inch to 2 inches of water available in the 10 to 20 inches of effective rooting depth.

For both soils fertility is low, runoff is medium to rapid, and the erosion hazard is moderate to high.

These soils are used mainly for watershed and wildlife habitat. A limited acreage is used for range. Capability unit VIsc-4 (20) and Granitic range site for La Posta soil; Capability unit VIe-7 (20) and Loamy range site for Sheephead soil; Capability unit VIIIs-1 (20) for Rock outcrop.

La Posta-Sheephead complex, 30 to 65 percent slopes (LdG).--This unit is about 50 percent La Posta loamy coarse sand and 40 percent Sheephead cobbly fine sandy loam. It occurs on mountainous uplands, at elevations of 2,500 to 5,000 feet. Rock outcrop covers 5 to 10 percent of the surface.

Included in mapping are small areas of Tollhouse soils and Acid igneous rock land.

Detailed information about the La Posta soil is given in the description of La Posta loamy coarse sand, 5 to 30 percent slopes, eroded. Detailed information about the Sheephead soil is given in the description of Sheephead rocky fine sandy loam, 30 to 65 percent slopes, eroded, under the heading "Sheephead Series."

La Posta loamy coarse sand is somewhat excessively drained, is rapidly permeable in the subsoil, and has 1 inch to 2 inches of water available in the 16 to 26 inches of effective rooting depth.

Sheephead cobbly fine sandy loam is well drained, is moderately rapidly permeable, and has 1 inch to 1.5 inches of water available in the 10 to 18 inches of effective rooting depth.

For both soils fertility is low, runoff is rapid to very rapid, and the erosion hazard is high to very high.

These soils are used mainly for watershed. Capability unit VIIe-7 (20) for both soils; Capability unit VIIIs-1 for Rock outcrop; Granitic range site for La Posta soil; Loamy range site for Sheephead soil.

Las Flores Series

The Las Flores series consists of moderately well drained loamy fine sands that have a sandy clay subsoil. These soils formed in material weathered from siliceous marine sandstone. They are on uplands and have slopes of 2 to 30 percent. The elevation ranges from 100 to 500 feet. The mean annual precipitation is between 10 and 13 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 300 to 340 days. The

winter growing season has only light frost. The vegetation is chiefly Australian saltbush, anise, vinegarweed, tarweed, riggut brome, and soft chess.

In a representative profile the surface layer is light brownish-gray, slightly acid and medium acid loamy fine sand about 14 inches thick (pl. III). The subsoil is grayish-brown and light brownish-gray, slightly acid and neutral sandy clay about 24 inches thick. The substratum is pale-yellow, neutral loamy coarse sand that grades to decomposed sandstone at a depth of about 48 inches.

Las Flores soils are used for range, truck crops, and housing developments.

Las Flores loamy fine sand, 9 to 15 percent slopes, eroded (LeD2).--This rolling soil is on uplands. The slope averages 10 percent.

Representative profile: About 5 miles west of Vista on State Highway 78, approximately 1,600 feet west-southwest of northeast corner of sec. 33, T. 11 S., R. 4 W.

A11--0 to 3 inches, light brownish-gray (10YR 6/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak, fine, granular structure; soft, very friable, nonsticky, nonplastic; many very fine roots; many very fine interstitial pores; medium acid (pH 5.8); abrupt, smooth boundary.

A12--3 to 14 inches, light brownish-gray (10YR 6/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; massive; hard, friable, nonsticky, nonplastic; common fine roots; many fine tubular pores; slightly acid (pH 6.2); abrupt, wavy boundary.

B21t--14 to 22 inches, grayish-brown (10YR 5/2) sandy clay, dark grayish brown (10YR 4/2) moist; strong, medium, columnar structure; very hard, firm, very sticky, very plastic; few very fine exped roots; common very fine tubular pores; continuous moderately thick clay films on ped faces; slightly acid (pH 6.5); gradual, smooth boundary.

B22t--22 to 38 inches, light brownish-gray (10YR 6/2) sandy clay, grayish brown (10YR 5/2) moist; strong, medium, prismatic structure; very hard, firm, very sticky, very plastic; few very fine exped roots; common very fine tubular pores; continuous thick clay films on ped faces; neutral (pH 6.8); diffuse, irregular boundary.

C1--38 to 48 inches, pale-yellow (5Y 8/3) loamy coarse sand, pale yellow (5Y 8/4) moist; weak, coarse, angular blocky structure; hard, friable, slightly sticky, nonplastic; very few fine exped roots; few fine tubular pores; few moderately thick clay films on ped faces; neutral (pH 7.0); diffuse, smooth boundary.

C2--48 inches, light-gray (5Y 7/1) soft marine sandstone; few fine tubular pores; few moderately thick clay films along fracture planes; neutral (pH 7.3).

The A horizon ranges from light brownish gray to grayish brown or pale brown in color, from loamy

sand to loamy fine sand in texture, and from 10 to 16 inches in thickness. The B horizon ranges from grayish brown to light brownish gray or dark gray in color, from sandy clay to clay in texture, and from 18 to 28 inches in thickness. The lower part of the B horizon contains a few soft lime concretions. The C horizon ranges from pale yellow to light gray or white in color. It grades to decomposed sandstone, which is at a depth of 42 to 52 inches.

Included with this soil in mapping are small areas of Diablo soils, Huerhuero soils, and Linne soils. Also included are severely eroded soils.

Fertility is low to medium. Permeability is very slow. The available water holding capacity is 3 to 4 inches; some moisture is available from the sandy clay subsoil. Runoff is medium, and the erosion hazard moderate. The rooting depth is about 16 to 26 inches. Erosion has been moderate.

This soil is used for flowers and for range. Capability unit IVe-3 (19); Claypan range site.

Las Flores loamy fine sand, 2 to 9 percent slopes (LeC).--This soil is not eroded. It is gently sloping to moderately sloping and has an 18- to 24-inch surface layer. The rooting depth is 20 to 40 inches. The available water holding capacity is 4 to 5 inches. Runoff is slow to medium, and the erosion hazard slight to moderate. In other features, this soil is similar to Las Flores loamy fine sand, 9 to 15 percent slopes, eroded.

Included in mapping are small areas of Diablo soils, Huerhuero soils, Linne soils, and severely eroded Las Flores soils.

This Las Flores soil is used for flowers, range, truck crops, and housing developments. Capability unit IVe-3 (19); Claypan range site.

Las Flores loamy fine sand, 5 to 9 percent slopes, eroded (LeC2).--This soil is moderately sloping. The rooting depth is 18 to 37 inches. Rill and gully erosion are evident. Runoff is slow to medium, and the erosion hazard slight to moderate. In other features, this soil is similar to Las Flores loamy fine sand, 9 to 15 percent slopes, eroded.

Included in mapping are small areas of Diablo soils, Huerhuero soils, Linne soils, and severely eroded Las Flores soils.

This Las Flores soil is used for flowers, range, truck crops, and housing developments. Capability unit IVe-3 (19); Claypan range site.

Las Flores loamy fine sand, 9 to 15 percent slopes (LeD).--This soil is strongly sloping but is not eroded. The rooting depth is 16 to 31 inches. Runoff is medium, and the erosion hazard moderate. In other features, this soil is similar to Las Flores loamy fine sand, 9 to 15 percent slopes, eroded.

Included in mapping are small areas of Diablo soils, Huerhuero soils, Linne soils, and severely eroded Las Flores soils.

This Las Flores soil is used for flowers, range, and housing developments. Capability unit IVe-3 (19); Claypan range site.

Las Flores loamy fine sand, 15 to 30 percent slopes (LeE).--This soil is moderately steep but is not eroded. The rooting depth is 16 to 28 inches. The available water holding capacity is 2.5 to 3.5 inches; moisture is slowly available from the sandy clay subsoil. Runoff is medium to rapid, and the erosion hazard moderate to high. In other features, this soil is similar to Las Flores loamy fine sand, 9 to 15 percent slopes, eroded.

Included in mapping are small areas of Diablo soils, Huerhuero soils, and Linne soils.

This Las Flores soil is used for range. Capability unit VIe-3 (19); Claypan range site.

Las Flores loamy fine sand, 15 to 30 percent slopes, eroded (LeE2).--This soil is moderately steep. The rooting depth is 16 to 26 inches. Rill and gully erosion are evident. The available water holding capacity is 2 to 3 inches; moisture is slowly available from the sandy clay subsoil. Runoff is medium to rapid, and the erosion hazard moderate to high. In other features, this soil is similar to Las Flores loamy fine sand, 9 to 15 percent.

Included in mapping are areas of Diablo soils, Huerhuero soils, and Linne soils.

This Las Flores soil is used for range. Capability unit VIe-3 (19); Claypan range site.

Las Flores loamy fine sand, 9 to 30 percent slopes, severely eroded (LeE3).--This soil is strongly sloping to moderately steep. The rooting depth is 16 to 20 inches. Most of the surface layer and in places as much as half the subsoil have been removed by rill and gully erosion. The available water holding capacity is 2 to 3 inches; moisture is slowly available from the sandy clay subsoil. Runoff is medium to rapid, and the erosion hazard moderate to high. In other features, this soil is similar to Las Flores loamy fine sand, 9 to 15 percent slopes, eroded.

Included in mapping are areas of Diablo soils, Huerhuero soils, and Linne soils.

This Las Flores soil is used for range and housing developments. Capability unit VIIe-1 (19); Claypan range site.

Las Flores-Urban land complex, 2 to 9 percent slopes (LfC).--This complex occurs on uplands, at elevations of 100 to 500 feet. The landscape has been altered through cut and fill operations and leveling for building sites. Before cut and fill operations and leveling, the slope was 2 to 9 percent.

The material exposed in the cuts consists of soft marine sandstone. The material in the fills is a mixture of loamy fine sand and sandy clay and soft marine sandstone. Cuts and fills should be determined by onsite investigation. Between the leveled building lots are moderately steep escarpments that are easily eroded.

The entire acreage is used for homesites.

Las Flores-Urban land complex, 9 to 30 percent slopes (LfE).--This complex occurs on uplands, at elevations of 100 to 500 feet. The landscape has been altered through cut and fill operations and leveling for building sites. Before cut and fill operations and leveling, the slope was 9 to 30 percent.

The material exposed in the cuts consists of soft marine sandstone. The material in the fills is a mixture of loamy fine sand and sandy clay and soft marine sandstone. Cuts and fills should be determined by onsite investigation. Between the leveled building lots are very steep escarpments that are easily eroded.

The entire acreage is used for homesites.

Las Posas Series

The Las Posas series consists of well-drained, moderately deep stony fine sandy loams that have a clay subsoil. These soils are on uplands and have slopes of 2 to 65 percent. They formed in material weathered from basic igneous rocks. The elevation ranges from 200 to 3,000 feet. The mean annual precipitation is between 12 and 18 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 240 to 320 days. The vegetation is chaparral-oak, including chamise, sumac, ceanothus, California sagebrush, annual grasses, and, in mountainous areas, a few scattered oaks.

In a representative profile, the surface layer is reddish-brown, neutral stony fine sandy loam about 4 inches thick. The subsoil is reddish-brown and red, neutral light clay and clay loam about 29 inches thick. The substratum is yellowish-red, deeply weathered gabbro. In some areas the surface layer is fine sandy loam.

Las Posas soils are used for flowers, citrus, tomatoes, field crops, range, wildlife habitat, and watershed.

Las Posas stony fine sandy loam, 30 to 65 percent slopes (LrG).--This steep to very steep soil is on uplands. The slope averages 35 percent.

Representative profile: 1 mile west of highway 395 on east side of hill, SW 1/4 of NW 1/4 sec. 11, T. 9 S., R. 3 W.

A1--0 to 4 inches, reddish-brown (5YR 4/3) stony fine sandy loam, dark reddish brown (5YR 3/3) moist; moderate, medium, granular and subangular blocky structure; slightly hard, friable, nonsticky, nonplastic; many very fine and fine roots; few medium interstitial pores, many fine interstitial pores; 25 percent stones; neutral (pH 7.3); abrupt, smooth boundary.

B21t--4 to 14 inches, reddish-brown (2.5YR 4/4) light clay, dark reddish brown (2.5YR 3/4) moist; strong, medium and coarse, subangular blocky structure; very hard, friable, sticky, plastic; common medium and fine roots; many fine tubular pores; continuous moderately thick clay films; neutral (pH 7.0); clear, smooth boundary.

B22t--14 to 26 inches, red (2.5YR 4/6) light clay, dark red (2.5YR 3/6) moist; strong, medium and coarse, subangular blocky structure; very hard, friable, sticky, plastic; common medium and coarse random roots; many fine tubular pores; continuous moderately thick clay films; neutral (pH 6.8); clear, wavy boundary.

B3t--26 to 33 inches, red (2.5YR 4/8) clay loam, red (2.5YR 4/8) moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky, slightly plastic; common medium to coarse random roots; many fine tubular pores; many thick clay films; neutral (pH 6.8); clear, wavy boundary.

C--33 inches, yellowish-red (5YR 5/8) decomposed gabbro, red (2.5YR 5/8) moist; slightly acid (pH 6.5); gradual, smooth boundary.

The A horizon ranges from reddish brown to dark brown or brown in color, from stony fine sandy loam to stony clay loam in texture, and from 3 to 5 inches in thickness. This horizon is 20 to 30 percent stones. The B horizon ranges from reddish brown to red or dark reddish brown in color, from clay to clay loam in texture, and from 23 to 35 inches in thickness. The C horizon ranges from yellowish red to reddish yellow in color and from fine sandy loam to loamy fine sand in texture. This material grades to basic igneous rock, which is at a depth of 26 to 40 inches.

Included with this soil in mapping are small areas of Fallbrook soils, Bancas soils, Escondido soils, and Friant soils. Also included is about 800 acres, north of Camp Pendleton, that is underlain by basalt, and areas where the subsoil is stony.

Fertility is medium. Permeability is moderately slow in the subsoil. The available water holding capacity is 4 to 6 inches. Runoff is rapid to very rapid, and the erosion hazard high to very high.

This soil is used for range, watershed, and wildlife habitat. Capability unit VIIe-7 (19, 20); Shallow Loamy range site.

Las Posas fine sandy loam, 2 to 5 percent slopes (LpB).--This soil is not stony. It is gently sloping, has an 8- to 10-inch surface layer, and is 28 to 40 inches deep over hard rock. Runoff is slow, and the erosion hazard is slight. In other features, this soil is similar to Las Posas stony fine sandy loam, 30 to 65 percent slopes.

Included in mapping are small areas of Fallbrook soils and Escondido soils.

This Las Posas soil is used for flowers, citrus, tomatoes, truck crops, and range. Capability unit IIIe-1 (19); Loamy range site.

Las Posas fine sandy loam, 5 to 9 percent slopes (LpC).--This soil is not stony. It is moderately sloping, has an 8- to 10-inch surface layer, and is 28 to 40 inches deep over hard rock. Runoff is slow to medium, and the erosion hazard is slight to moderate. In other features, this soil is similar to

Las Posas stony fine sandy loam, 30 to 65 percent slopes.

Included in mapping are small areas of Fallbrook soils and Escondido soils. Also included are small areas where the soil is only 10 to 20 inches deep over rock.

This soil is used for citrus, tomatoes, flowers, truck crops, and range. Capability unit IIIe-1 (19); Loamy range site.

Las Posas fine sandy loam, 5 to 9 percent slopes, eroded (LpC2).--This soil is not stony. It is moderately sloping, has a 4- to 6-inch surface layer, and is 26 to 40 inches deep over hard rock. Runoff is slow to medium, and the erosion hazard is slight to moderate. Shallow rills have formed. In other features, this soil is similar to Las Posas stony fine sandy loam, 30 to 65 percent slopes.

Included in mapping are small areas of Fallbrook soils and Escondido soils.

This soil is used for citrus, tomatoes, flowers, truck crops, and range. Capability unit IIIe-1 (19); Loamy range site.

Las Posas fine sandy loam, 9 to 15 percent slopes, eroded (LpD2).--This soil is not stony. It is strongly sloping, has a 4- to 6-inch surface layer, and is 26 to 40 inches deep over hard rock. Runoff is medium, and the erosion hazard moderate. Rill erosion is evident. In other features, this soil is similar to Las Posas stony fine sandy loam, 30 to 65 percent slopes.

Included in mapping are small areas of Fallbrook soils and Escondido soils.

This soil is used for citrus, tomatoes, flowers, and range. Capability unit IVe-1 (19); Loamy range site.

Las Posas fine sandy loam, 15 to 30 percent slopes, eroded (LpE2).--This soil is not stony. It is moderately steep, has a 4- to 6-inch surface layer, and is 26 to 40 inches deep over hard rock. Runoff is medium to rapid, and the erosion hazard is moderate to high. Rill erosion is evident. In other features, this soil is similar to Las Posas stony fine sandy loam, 30 to 65 percent slopes.

Included in mapping are small areas of Fallbrook soils, Bancas soils, Escondido soils, and Friant soils.

This soil is used for citrus and for range. Capability unit VIe-1 (19); Loamy range site.

Las Posas stony fine sandy loam, 9 to 30 percent slopes (LrE).--This soil is strongly sloping to moderately steep and is 26 to 40 inches deep over hard rock. Runoff is medium to rapid, and the erosion hazard is moderate to high. In other features, this soil is similar to Las Posas stony fine sandy loam, 30 to 65 percent slopes.

Included in mapping are small areas of Fallbrook soils, Bancas soils, Escondido soils, and Friant soils. Also included is 580 acres of soil that is underlain by basalt.

This soil is used for range and watershed. Capability unit VIe-7 (19, 20); Loamy range site.

Las Posas stony fine sandy loam, 9 to 30 percent slopes, eroded (LrE2).--This soil is strongly sloping to moderately steep and is 26 to 40 inches deep over hard rock. Runoff is medium to rapid, and the erosion hazard moderate to high. Rill erosion is evident. In other features, this soil is similar to Las Posas stony fine sandy loam, 30 to 65 percent slopes.

Included in mapping are small areas of Fallbrook soils, Bancas soils, Escondido soils, and Friant soils. Making up about 30 percent of this mapping unit are areas where the surface layer is grayish-brown to pale-brown rocky sandy loam, the subsoil is light brownish-gray heavy fine sandy loam to clay loam, and the substratum is weathered quartz diorite.

This soil is used for range, watershed, and wildlife. Capability unit VIe-7 (19, 20); Loamy range site.

Linne Series

The Linne series consists of well-drained, moderately deep clay loams derived from soft calcareous sandstone and shale. These soils are on uplands and have slopes of 9 to 50 percent. The elevation ranges from 100 to 600 feet. The mean annual precipitation is between 12 and 14 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 280 to 330 days. The winter growing season has only light frost. The vegetation is chiefly flattop buckwheat, California sagebrush, sugarbush, and scrub oak.

In a representative profile the surface layer is gray, moderately alkaline, calcareous heavy clay loam about 15 inches thick. The next layer is gray, moderately alkaline, calcareous heavy clay loam about 13 inches thick. Below this is gray and white, moderately alkaline, calcareous clay loam. The substratum is soft, white, calcareous shale. It occurs at a depth of about 37 inches.

Linne soils are used mainly for range. A small acreage is used for farm crops.

Linne clay loam, 9 to 30 percent slopes (LsE).--This rolling to hilly soil is on uplands. The slope averages 16 percent.

Representative profile: Approximately 150 feet west of entrance to Otay Ranch headquarters on Telegraph Canyon Road, NW 1/4 of NW 1/4 sec. 8, T. 18 S., R. 1 W.

Ap--0 to 7 inches, gray (10YR 5/1) heavy clay loam, very dark gray (10YR 3/1) moist; moderate, fine and medium, granular structure; slightly hard, very friable, slightly sticky, slightly plastic; few fine and medium roots; many, very fine, tubular pores; few fine lime mottles; strongly effervescent, moderately alkaline (pH 7.9); clear, smooth boundary.

A1--7 to 15 inches, gray (10YR 5/1) heavy clay loam, very dark gray (10YR 3/1) moist; weak, medium and coarse, subangular blocky to moderate, fine, granular structure; hard, very friable, slightly sticky, slightly plastic; common fine roots; many, very fine, tubular pores and few fine tubular pores; few fine lime mottles; strongly effervescent, moderately alkaline (pH 8.0); gradual, wavy boundary.

A&C1--15 to 28 inches, gray (10YR 6/1) heavy clay loam, dark gray (10YR 4/1) moist; horizon mixed by ground squirrel activity; weak, fine and medium, subangular blocky structure; hard, friable, slightly sticky, slightly plastic; few very fine roots; common very fine and medium tubular pores; many medium lime mottles; strongly effervescent, moderately alkaline (pH 8.0); clear, wavy boundary.

C2--28 to 37 inches, gray and white (10YR 6/1-8/2) clay loam, dark gray and light gray (10YR 4/1-7/2) moist; weak, coarse, subangular blocky structure; hard, friable, slightly sticky, slightly plastic; few very fine roots; few very fine and fine tubular pores; many large lime mottles; strongly effervescent, moderately alkaline (pH 8.1); gradual, wavy boundary.

C3--37 inches, white (10YR 8/2) sandy shale; weak lime mottles; violently effervescent, moderately alkaline (pH 8.2); many feet thick.

The A horizon ranges from gray to dark gray in color, from heavy clay loam to silty clay loam in texture, and from 12 to 18 inches in thickness. The A&C1 horizon ranges from gray to light gray in color, from clay loam to sandy loam in texture, and from 10 to 16 inches in thickness. The C horizon ranges from gray to white in color, from clay loam to loam in texture, and from 7 to 12 inches in thickness. This soil is calcareous throughout the profile. The Linne soil in this Area has a thinner, darker colored A horizon than the Linne soils mapped elsewhere in California.

Included with this soil in mapping are small areas of Diablo soils, Altamont soils, and Huerfuerio soils.

Fertility is medium. Permeability is moderately slow. The available water holding capacity is 5 to 7 inches. Runoff is medium to rapid, and the erosion hazard moderate to high. The rooting depth is 28 to 40 inches.

This soil is used mostly for range. A small acreage is used for farming. Capability unit IVE-1 (19); Clayey range site.

Linne clay loam, 30 to 50 percent slopes (LsF).--This soil is steep and is about 26 to 38 inches deep over soft shale. Runoff is rapid, and the erosion hazard high. In other features, this soil is similar to Linne clay loam, 9 to 30 percent slopes.

Included in mapping are small areas of Diablo soils, Altamont soils, and Huerfuerio soils.

This Linne soil is used for range. Capability unit VIe-1 (19); Clayey range site.

Loamy Alluvial Land

Loamy alluvial land consists of somewhat poorly drained, very deep, very dark brown to black silt loams and sandy loams. Areas of this land were formerly wet meadows that were subsequently drained by head cutting of gullies. The gullies eventually formed drainage ditches and thus lowered the water table. The land now is seldom saturated except in winter, when overflow is a hazard. Most of the water-tolerant vegetation has disappeared.

The acreage is used mainly for pasture and range.

Loamy alluvial land (Lu)--This land type occurs in mountainous areas and has slopes of 0 to 5 percent. The soil material is neutral to medium acid. Fertility is medium to high. Permeability is moderate. From 6 to 9 inches of moisture is available in the 60 inches of effective rooting depth. In many places the underlying material is stratified with lenses of silt loam to fine sand.

This land type is used mainly for pasture and range. Capability unit IIw-2 (20); Wet Meadows range site.

Loamy alluvial land-Huerhuero complex, 9 to 50 percent slopes, severely eroded (LvF3)--This complex occurs on old coastal ridges. The landscape is one of strongly sloping to steep, severely eroded soils and alluvial fill along drainageways. Shallow rills and gullies have formed in most of the drainageways, at intervals of 5 to 25 feet. The elevation ranges from sea level to 500 feet.

Remnants of Huerhuero loam, Carlsbad gravelly loamy sand, Chesterton fine sandy loam, and other soils occupy the more gentle slopes. There are many barren exposures of soft marine sediments, sandstone, and shale. The areas of sandstone and shale are rolling to steep and have a network of very shallow drainageways.

The Huerhuero, Carlsbad, and Chesterton soils are severely eroded. The Huerhuero and Carlsbad soils have lost all of their original surface layer and about 75 percent of the subsoil. The Chesterton soil has been eroded down into the substratum.

Sparse coastal chaparral grows on these soils and in soft spots in the sandstone and shale.

Runoff is rapid, and erosion is severe.

This complex is used for housing developments. It is of no value for farming or ranching. Capability unit VIIIs-1 (19).

Made Land

Made land (Md) consists of smooth, level areas that have been filled with excavated and transported soil material, paving material, and soil material dredged from lagoons, bays, and harbors.

Frequently this land type is used for building sites. The largest areas are in the vicinity of San Diego Bay and Mission Bay. Capability unit VIIIE-1 (19).

Marina Series

The Marina series consists of somewhat excessively drained, very deep loamy coarse sands derived from weakly consolidated to noncoherent ferruginous eolian sand. These soils are on old beach ridges and have slopes of 2 to 30 percent. The elevation ranges from near sea level to 300 feet. The mean annual precipitation is between 12 and 14 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 330 to 350 days. The winter growing season has only light frost. The vegetation is mostly chamise, sumac, black sagebrush, flatter buckwheat, and annual grasses and forbs.

In a representative profile the surface layer is brown and dark yellowish-brown, medium acid and slightly acid loamy coarse sand about 10 inches thick. The subsoil is brown and strong-brown, neutral and mildly alkaline loamy coarse sand about 47 inches thick. The substratum is yellow, moderately alkaline coarse sand.

Marina soils are used for avocados, citrus, tomatoes, flowers, truck crops, recreational areas, and housing developments.

Marina loamy coarse sand, 2 to 9 percent slopes (M1C)--This undulating to gently rolling soil is on ridges. The slope is dominantly 4 percent.

Representative profile: Between old U.S. Highway 101 and the Atchison, Topeka, and Santa Fe Railway, approximately 0.5 mile south of La Costa Downs overpass, sec. 29, T. 17 S., R. 4 W.

- A11--0 to 2 inches, brown (10YR 4/3) loamy coarse sand, dark brown (10YR 3/3) moist; weak, fine, crumb structure; very friable, nonsticky, nonplastic; medium acid (pH 6.0); abrupt, smooth boundary.
- A12--2 to 10 inches, dark yellowish-brown (10YR 4/4) loamy coarse sand, dark yellowish brown (10YR 3/4) moist; massive; soft, friable, nonsticky, nonplastic; common very fine roots; slightly acid (pH 6.5); gradual, smooth boundary.
- B21--10 to 17 inches, brown (7.5YR 4/4) loamy coarse sand, dark reddish brown (5YR 3/4) moist; massive; slightly hard, friable, nonsticky, nonplastic; common very fine roots; neutral (pH 6.7); diffuse boundary.
- B22--17 to 25 inches, strong-brown (7.5YR 5/6) loamy coarse sand, dark reddish brown (7.5YR 3/4) moist; massive; slightly hard, friable, nonsticky, nonplastic; common very fine roots; neutral (pH 6.7); diffuse boundary.
- B23--25 to 35 inches, strong-brown (7.5YR 5/6) loamy coarse sand, brown (7.5YR 4/4) moist; massive; hard, friable, nonsticky, nonplastic; common

very fine roots; neutral (pH 6.7); diffuse boundary.

B3--35 to 57 inches, strong-brown (7.5YR 5/6) loamy coarse sand, dark reddish brown (5YR 3/4) moist; massive; hard, very friable, nonsticky, nonplastic; mildly alkaline (pH 7.5); diffuse boundary.

C--57 to 60 inches, yellow (10YR 7/6) coarse sand, yellowish brown (10YR 5/6) moist; massive; soft, very friable, nonsticky, nonplastic; moderately alkaline (pH 8.0).

The A horizon ranges from brown or dark yellowish brown to yellowish brown in color, from loamy coarse sand to loamy sand in texture, and from 6 to 14 inches in thickness. The B horizon ranges from brown to light brown to strong brown in color, from loamy coarse sand to loamy sand in texture, and from 27 to 47 inches in thickness.

Included with this soil in mapping are small areas of Carlsbad soils, Chesterton soils, and Corralitos soils.

Fertility is medium. Permeability is rapid. The available water holding capacity is 4 to 5 inches. Runoff is slow to medium, and the erosion hazard slight to moderate. The rooting depth is more than 60 inches.

This soil is used for avocados, citrus, tomatoes, flowers (pl. III), truck crops, recreational areas, and housing developments. Capability unit IIIs-4 (19).

Marina loamy coarse sand, 9 to 30 percent slopes (M1E).--This soil is rolling to hilly. Runoff is medium to rapid, and the erosion hazard moderate to high. In other features, this soil is similar to Marina loamy coarse sand, 2 to 9 percent slopes.

Included in mapping are small areas of Carlsbad soils, Chesterton soils, and Corralitos soils.

This Marina soil is used for avocados and citrus. Capability unit IVs-4 (19).

Mecca Series

The Mecca series consists of well-drained, very deep coarse sandy loams derived from granitic alluvium. These soils are on alluvial fans and alluvial plains and have slopes of 0 to 5 percent. The elevation ranges from 200 to 2,000 feet. The mean annual precipitation is between 4 and 6 inches, and the mean annual air temperature between 70° and 74° F. The frost-free season is 220 to 260 days. The vegetation is chiefly cactus, creosotebush, ocotillo, and annual grasses.

In a representative profile the surface layer is brown, moderately alkaline coarse sandy loam about 10 inches thick. The next layer is yellowish-brown, moderately alkaline, calcareous coarse sandy loam. It extends to a depth of more than 60 inches. In places this soil is fine sandy loam throughout the profile. In other places it is sandy loam and is moderately saline.

Mecca soils are used for range, irrigated alfalfa, small grain, and truck crops.

Mecca coarse sandy loam, 0 to 2 percent slopes (MnA).--This is a smooth, nearly level soil. The slope averages 1 percent.

Representative profile: 2,660 feet south, 700 feet east of northwest corner of sec. 18, T. 14 S., R. 6 E.

A--0 to 10 inches, brown (10YR 5/3) coarse sandy loam, dark brown (10YR 4/3) moist; weak, fine, granular structure; slightly hard, very friable, nonsticky, nonplastic; few fine roots; few very fine discontinuous pores; mildly alkaline (pH 7.8); clear, smooth boundary.

C--10 to 62 inches, yellowish-brown (10YR 5/4) coarse sandy loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, very friable, nonsticky, nonplastic; very few very fine and fine continuous pores; moderately alkaline (pH 8.0), slightly effervescent.

The A horizon ranges from brown to dark brown in color and from 8 to 12 inches in thickness. The C horizon ranges from yellowish brown or dark yellowish brown to light brown or reddish brown in color and from coarse sandy loam to loam in texture. This horizon extends to a depth of more than 60 inches.

Included with this soil in mapping are small areas of Rositas soils, Carrizo soils, and Indio soils.

Fertility is medium. Permeability is moderately rapid. The available water holding capacity is 5 to 6 inches. Runoff is very slow, and the erosion hazard is slight. The rooting depth is more than 60 inches.

This soil is used for range, irrigated alfalfa, small grain, and truck crops. Capability unit IIs-4 (30); Loamy range site.

Mecca coarse sandy loam, 2 to 5 percent slopes (MnB).--This soil is gently sloping. Runoff is slow, and the erosion hazard is slight. In other features, this soil is similar to Mecca coarse sandy loam, 0 to 2 percent slopes.

Included in mapping are small areas of Rositas soils, Carrizo soils, and Indio soils.

This soil is used for range, irrigated alfalfa, small grain, and truck crops. Capability unit IIs-1 (30); Loamy range site.

Mecca sandy loam, saline, 0 to 2 percent slopes (MoA).--This soil is nearly level. It is sandy loam throughout the profile and contains a moderate amount of soluble salts. The available water holding capacity is 6 to 7.5 inches. In other features, this soil is similar to Mecca coarse sandy loam, 0 to 2 percent slopes.

Included in mapping are small areas of Indio soils.

This Mecca soil is used for range. Capability unit IIIs-6 (30); Alkali Flats range site.

Mecca fine sandy loam, 0 to 2 percent slopes, eroded (MpA2).--The surface layer of this nearly level soil has been reworked by wind, and low hummocks have formed. The available water holding capacity is 7 to 8 inches. The erosion hazard, chiefly wind erosion, is moderate. Moderate sand abrasion frequently damages seedlings in spring. In other features, this soil is similar to Mecca coarse sandy loam, 0 to 2 percent slopes.

Included with this soil in mapping are small areas of Rositas soils, Carrizo soils, and Indio soils. Also included are areas where the soils are stratified with silt loam, very fine sand, and loamy fine sand.

This soil is used mainly for irrigated crops. Part of the acreage is in range. Capability unit IIe-4 (30); Loamy range site.

Metamorphic Rock Land

Metamorphic rock land (MrG) occurs as excessively drained, hilly to mountainous areas. Numerous areas are covered with rock outcrops and angular stones and cobblestones; in fact, exposed rock covers 50 to 90 percent of the entire acreage. The cobblestones, stones, and rock outcrops are metasedimentary or metavolcanic rocks. The soil material is very fine sandy loam to silt loam in texture and is generally less than 10 inches deep over hard rock. There are a few pockets of deeper soils between the rocks. The vegetation consists of chamise, ceanothus, sumac, yerba santa, white sagebrush, and annual grasses and forbs. Much of the acreage is practically barren.

Runoff is rapid to very rapid.

This land type is of no value for farming or ranching. It is suitable only for wildlife habitat and watershed. Capability unit VIIIs-1 (19, 20).

Mottsville Series

The Mottsville series consists of excessively drained, very deep, loamy coarse sands that in some areas formed in sandy sediments transported from granitic rock, and in others in material weathered in place from granitic rock. These soils occur in valleys and on alluvial fans and have slopes of 0 to 15 percent. The elevation ranges from 2,500 to 4,500 feet. The mean annual precipitation is between 14 and 20 inches, and the mean annual air temperature between 57° and 59° F. The frost-free season is 150 to 200 days. The vegetation is chiefly California live oak, sagebrush, buckwheat, and annual grasses.

In a representative profile the surface layer is grayish-brown, slightly acid loamy coarse sand about 6 inches thick. The next layer is brown, slightly acid loamy coarse sand. It extends to a depth of more than 60 inches.

Mottsville soils are used mainly for range. A few small areas are seeded to grain for hay or pasture.

Mottsville loamy coarse sand, 2 to 9 percent slopes (MvC).--This gently sloping to moderately sloping soil is on alluvial fans and alluvial plains. The slope averages 8 percent.

Representative profile: 1,300 feet west and 800 feet north of southeast corner of sec. 16, T. 17 S., R. 5 E.

A--0 to 6 inches, grayish-brown (10YR 5/2) loamy coarse sand, very dark grayish brown (10YR 3/2) moist; very weak, medium, granular structure; soft, very friable, nonsticky, nonplastic; common very fine roots, few medium roots; many very fine dendritic and interstitial pores; slightly acid (pH 6.4); gradual, smooth boundary.

C--6 to 60 inches, brown (10YR 5/3) loamy coarse sand, dark brown (10YR 3/3) moist; massive; soft, very friable, nonsticky, nonplastic; few very fine to medium roots, very few coarse roots; common very fine interstitial and dendritic pores; slightly acid (pH 6.4).

The A horizon ranges from grayish brown or dark grayish brown to brown in color and from 4 to 11 inches in thickness. The C horizon ranges from brown to grayish brown in color and extends to a depth of more than 60 inches. This layer is stratified with fine gravelly sand.

Included with this soil in mapping are small areas of Calpine soils, Bull Trail soils, and La Posta soils. Also included are a few areas where the surface layer is coarse sandy loam.

Fertility is low to medium. Permeability is very rapid. The available water holding capacity is about 4 to 5 inches. Runoff is slow to medium, and the erosion hazard slight to moderate. The rooting depth is more than 60 inches.

This soil is used mostly for range. A few small areas are seeded to small grain for hay or pasture. Capability unit IVsc-4 (20); Sandy range site.

Mottsville loamy coarse sand, 0 to 2 percent slopes (MvA).--This soil is nearly level. Very infrequently it is flooded during prolonged winter storms. Runoff is very slow, and the erosion hazard is slight. In other features, this soil is similar to Mottsville loamy coarse sand, 2 to 9 percent slopes.

Included in mapping are small areas of Calpine soils, Bull Trail soils, and La Posta soils.

This Mottsville soil is used mainly for range. Local areas are occasionally seeded to small grain for pasture or hay. Capability unit IVsc-4 (20); Sandy range site.

Mottsville loamy coarse sand, 9 to 15 percent slopes (MvD).--This soil is strongly sloping. Runoff is medium, and the erosion hazard is moderate. In other features, this soil is similar to Mottsville loamy coarse sand, 2 to 9 percent slopes.

Included in mapping are small areas of Calpine soils, Bull Trail soils, and La Posta soils. Also included are areas where gravel has been washed from

the steep slopes onto the alluvial fans and the surface layer is gravelly.

This soil is used for range. Capability unit IVsc-4 (20); Sandy range site.

Mottsville loamy coarse sand, wet, 0 to 2 percent slopes (MxA).--This nearly level soil is on flood plains and has an intermittent water table 4 to 36 inches below the surface. It is wet for relatively long periods in winter because of blockage in drainage outlets. Fertility is medium. Permeability is rapid. Runoff is very slow, and the erosion hazard is slight. In other features, this soil is similar to Mottsville loamy coarse sand, 2 to 9 percent slopes.

Included in mapping are small areas of Calpine soils. Also included are areas where the surface layer is very dark grayish brown and areas where the surface layer and the subsoil are coarse sandy loam.

This Mottsville soil is used for range. Capability unit Vw-1 (20); Wet Meadows range site.

Olivenhain Series

The Olivenhain series consists of well-drained, moderately deep to deep cobbly loams that have a very cobbly clay subsoil. These soils formed in old gravelly and cobbly alluvium. They are on dissected marine terraces and have slopes of 2 to 50 percent. The elevation ranges from 100 to 600 feet. The mean annual precipitation is between 12 and 16 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 290 to 330 days. The vegetation in uncultivated areas is mainly chamise, scrub oak, flattop buckwheat, wild oats, sugarbush, soft chess, and cactus.

In a representative profile the surface layer is brown and reddish-brown, medium acid cobbly loam about 10 inches thick. The subsoil is reddish-brown, red, and pink, strongly acid very cobbly clay and clay loam about 32 inches thick. The substratum is pinkish-white, strongly acid cobbly loam.

Olivenhain soils are used mainly for range and watershed. Small areas are used for housing developments and for citrus.

Olivenhain cobbly loam, 2 to 9 percent slopes (OhC).--This soil is gently sloping to moderately sloping. In many places microrelief of broad-base low hummocks, locally called mimamounds, is evident. The hummock averages 7 percent.

Representative profile: Approximately 2,450 feet east of old Highway 395 (Pomerado Road) on top of ridge, SW 1/4 of NE 1/4 sec. 11, T. 14 S., R. 2 W., approximately 2 miles northeast of Poway.

All--0 to 6 inches, brown (7.5YR 4/4) cobbly loam, dark reddish brown (5YR 3/4) moist; weak, medium and fine, granular structure; soft, friable, nonsticky, nonplastic; common medium roots, many very fine and fine roots; many fine and very fine interstitial pores, common fine tubular pores; 25 percent cobblestones;

medium acid (pH 5.7); abrupt, wavy and irregular boundary.

A12--6 to 10 inches, reddish-brown (5YR 4/4) cobbly heavy loam, dark reddish brown (5YR 3/4) moist; weak and moderate, medium, subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine and fine roots, few medium roots; common fine interstitial pores, common fine tubular pores; 25 percent cobblestones; medium acid (pH 5.6); abrupt, wavy and irregular boundary.

B21t--10 to 19 inches, reddish-brown (5YR 4/4) very cobbly clay loam, reddish brown (5YR 4/4) moist; mottled with reddish brown (2.5YR 4/4) and dark reddish brown (2.5YR 3/4) moist; moderate, medium, subangular blocky structure; very hard, firm, sticky, plastic; few fine and very fine roots, very few medium roots; few very fine and fine tubular pores; common moderately thick clay films in pores and on ped faces and gravel particles; 40 percent cobblestones; strongly acid (pH 5.6); clear, wavy and irregular boundary.

B22t--19 to 29 inches, red (2.5YR 5/6) very cobbly clay, red (2.5YR 4/6) moist; mottled with yellowish red and reddish brown (5YR 5/3, 5/6), reddish brown and yellowish red (5YR 4/3, 4/6) moist; weak and moderate, coarse, subangular and angular blocky structure; very hard, firm, sticky, plastic; few fine and medium roots; very few fine tubular pores; common thin and moderately thick clay films in pores and on ped faces and gravel particles; 40 percent cobblestones; strongly acid (pH 5.4); clear, wavy and irregular boundary.

B3--29 to 42 inches, pink (5YR 8/3) very cobbly clay loam, light reddish brown (5YR 6/3) moist; mottled with pinkish white (7.5YR 3/2), pinkish gray (7.5YR 6/2) moist; massive; hard, friable, slightly sticky, slightly plastic; very few fine and medium roots; few thin and moderately thick clay films on gravel particles; 40 percent cobblestones; strongly acid (pH 5.3); clear, wavy and irregular boundary.

C--42 to 60 inches, pinkish-white (7.5YR 8/2) cobbly loam, pinkish gray (7.5YR 6/2) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; very few fine and medium roots; 25 percent cobblestones; strongly acid (pH 5.1).

The A horizon ranges from brown or reddish brown to yellowish brown in color, from cobbly loam to cobbly sandy loam in texture, and from 8 to 14 inches in thickness. The B horizon has colors of reddish brown to red and pink or dark reddish brown and mixed colors resembling reticulate mottling, including reddish brown, yellowish red, pinkish white, and pinkish gray. This horizon ranges from 22 to 41 inches in thickness and from very cobbly clay to very cobbly sandy clay and very cobbly clay loam in texture. The depth to the C horizon ranges from 30 to 55 inches. This soil is 25 to 35 percent cobblestones.

Included with this soil in mapping are small areas of Huerhuero soils, Diablo soils, and Linne soils.

Fertility is low. Permeability is very slow. The available water holding capacity is 2 to 3 inches. Runoff is slow to medium, and the erosion hazard slight to moderate. The rooting depth is 29 to 42 inches. The surface layer is 20 to 30 percent cobbles, and the subsoil 35 to 45 percent.

This soil is used mainly for range, watershed, and citrus. A limited acreage is used for housing developments. Capability unit VIe-7 (19); Claypan range site.

Olivenhain cobbly loam, 9 to 30 percent slopes (OhE).--This soil is strongly sloping to moderately steep and has an effective rooting depth of 20 to 27 inches. The available water holding capacity is 2 to 2.5 inches. Runoff is medium to rapid, and the erosion hazard moderate to high. In other features, this soil is similar to Olivenhain cobbly loam, 2 to 9 percent slopes.

Included in mapping are small areas of Huerhuero soils, Diablo soils, and Linne soils. Also included are small areas where sheet erosion has been moderate.

This Olivenhain soil is used for range, watershed, small housing developments, and citrus. Capability unit VIe-7 (19); Claypan range site.

Olivenhain cobbly loam, 30 to 50 percent slopes (OhF).--This soil is steep and has an effective rooting depth of 20 to 25 inches. The available water holding capacity is 2 to 2.5 inches. Runoff is rapid, and the erosion hazard high. In other features, this soil is similar to Olivenhain cobbly loam, 2 to 9 percent slopes.

Included in mapping are small areas of Huerhuero soils, Diablo soils, and Linne soils. Also included are areas where the subsoil is very cobbly sandy loam.

This Olivenhain soil is used for range and watershed. Capability unit VIIe-7 (19); Claypan range site.

Olivenhain-Urban land complex, 2 to 9 percent slopes (OkC).--This complex occurs on marine terraces, at elevations of 100 to 600 feet. The landscape has been altered through cut and fill operations and leveling for building sites. Before cut and fill operations and leveling, the slope was 2 to 9 percent.

The material exposed in the cuts is cobbly loamy alluvium. The material in the fills consists of cobbly loam and cobbly clay loam. Cuts and fills should be determined by onsite investigation. Between the leveled building lots are moderately steep escarpments that are easily eroded.

The entire acreage is used for homesites.

Olivenhain-Urban land complex, 9 to 30 percent slopes (OkE).--This complex occurs on marine terraces, at elevations of 100 to 600 feet. The landscape has been altered through cut and fill

operations and leveling for building sites (pl. IV). Before cut and fill operations and leveling, the slope was 2 to 9 percent.

The material exposed in the cuts is cobbly loamy alluvium. The material in the fills consists of cobbly loam and cobbly clay loam. Cuts and fills should be determined by onsite investigation. Between the leveled building sites are very steep escarpments that are easily eroded.

The entire acreage is used for homesites.

Placentia Series

The Placentia series consists of moderately well drained sandy loams that have a sandy clay subsoil. These soils formed in granitic alluvium. They are on old alluvial fans and have slopes of 0 to 15 percent. The elevation ranges from 200 to 1,800 feet. The mean annual precipitation is between 14 and 18 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 260 to 320 days. The vegetation consists of a few scattered oaks, soft chess, wild oats, filaree, chamise, and vinegarweed.

In a representative profile the surface layer is brown, medium acid and slightly acid sandy loam about 13 inches thick. The subsoil is brown, moderately alkaline sandy clay and sandy clay loam about 40 inches thick. This layer is calcareous in the lowermost part. It is underlain by yellowish-brown, moderately alkaline sandy clay loam.

Placentia soils are used mainly for dryfarmed crops, range, tomatoes, and flowers. A few areas are irrigated and are used for orchards and small grain.

Placentia sandy loam, 2 to 9 percent slopes (PeC).--This gently sloping to moderately sloping soil is on alluvial fans and alluvial plains. The slope averages 3 percent.

Representative profile: Approximately 1/2 mile south-southwest of intersection of Artic Street and Grand Avenue, NE 1/4 of NE 1/4 sec. 16, T. 12 S., R. 3 W.

A11--0 to 4 inches, brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; weak, medium, granular structure; slightly hard, friable, nonsticky, nonplastic; many very fine and fine roots; many very fine and fine interstitial pores; medium acid (pH 6.0); clear, smooth boundary.

A12--4 to 13 inches, brown (10YR 5/3) sandy loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable, nonsticky, nonplastic; common very fine roots, few fine roots; many very fine and fine tubular pores; slightly acid (pH 6.3); abrupt, smooth boundary.

B21t--13 to 21 inches, brown (7.5YR 4/4) light sandy clay, dark brown (10YR 3/2) moist; strong, coarse, prismatic structure; extremely hard, very firm, sticky, very plastic; few very fine roots in interfaces between peds; common

very fine tubular pores; many moderately thick clay films on ped faces; moderately alkaline (pH 8.0); clear, smooth boundary.

B22t--21 to 34 inches, brown (7.5YR 4/4) sandy clay, dark brown (10YR 3/2) moist; strong, coarse, prismatic structure; extremely hard, very firm, sticky, very plastic; few very fine roots in interfaces between peds; common very fine tubular pores; many moderately thick clay films on ped faces; lime concretions; strongly effervescent, moderately alkaline (pH 8.0); clear, smooth boundary.

B3--34 to 53 inches, brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; common, fine, distinct, brown mottles and common, fine, prominent, black mottles; massive; hard, firm, sticky, slightly plastic; common very fine tubular pores; segregated lime and lime concretions; slightly effervescent, moderately alkaline (pH 8.0); clear, smooth boundary.

C--53 to 63 inches, yellowish-brown (10YR 5/4) light sandy clay loam, dark yellowish brown (10YR 4/4) moist; common, medium, prominent, reddish-brown and black mottles; massive; hard, firm, slightly sticky, slightly plastic; few very fine roots; few very fine tubular pores; moderately alkaline (pH 8.0).

The A horizon ranges from brown or grayish brown to pale brown in color, is sandy loam or fine sandy loam in texture, and ranges from 9 to 19 inches in thickness. The B horizon ranges from brown to dark brown or reddish brown in color, from sandy clay to heavy clay loam in texture, and from 19 to 43 inches in thickness. Depth to the C horizon ranges from 28 to 62 inches.

Included with this soil in mapping are small areas of Bonsall soils, Ramona soils, and Fallbrook soils.

Fertility is low to medium. The available water holding capacity is 3 to 4 inches; some moisture is slowly available from the sandy clay subsoil. Permeability is very slow in the subsoil. Runoff is slow to medium, and the erosion hazard slight to moderate. The rooting depth is 9 to 19 inches; roots are restricted by the sandy clay subsoil.

This soil is used mainly for tomatoes, flowers, dryfarmed crops, and range. A small acreage under irrigation is used for orchards and grain crops. Capability unit IVe-3 (19); Claypan range site.

Placentia sandy loam, 0 to 2 percent slopes (PeA).--This soil is nearly level and has an effective rooting depth of 10 to 20 inches. Runoff is very slow, and the erosion hazard is slight. In other features, this soil is similar to Placentia sandy loam, 2 to 9 percent slopes.

Included in mapping are small areas of Placentia sandy loam, thick surface, and Ramona sandy loam.

This Placentia soil is used mainly for tomatoes, flowers, dryfarmed crops, and range. A small acreage is used for orchards and grain crops. Capability unit IVs-3 (19); Claypan range site.

Placentia sandy loam, 5 to 9 percent slopes, eroded (PeC2).--This soil is moderately sloping and has an effective rooting depth of 9 to 17 inches. Runoff is slow to medium, and the erosion hazard slight to moderate. Sheet erosion and shallow rill erosion have been moderate. In other features, this soil is similar to Placentia sandy loam, 2 to 9 percent.

Included in mapping are small areas of Bonsall soils, Ramona soils, and Fallbrook soils.

This Placentia soil is used mainly for tomatoes, flowers, dryfarmed crops, and range. A small acreage is used for orchards and grain crops. Capability unit IVe-3 (19); Claypan range site.

Placentia sandy loam, 9 to 15 percent slopes, eroded (PeD2).--This soil is strongly sloping and has an effective rooting depth of 9 to 15 inches. Runoff is medium, and the erosion hazard moderate. Sheet and rill erosion have been moderate. In other features, this soil is similar to Placentia sandy loam, 2 to 9 percent slopes.

Included in mapping are small areas of Bonsall soils, Ramona soils, Fallbrook soils, and Visalia soils.

This Placentia soil is used for tomatoes, flowers, dryfarmed crops, and range. Capability unit IVe-3 (19); Claypan range site.

Placentia sandy loam, thick surface, 0 to 2 percent slopes (PfA).--This soil is nearly level, has a 20- to 36-inch surface layer, and has an effective rooting depth of 20 to 36 inches. Fertility is medium. The available water holding capacity is 4 to 5 inches. Runoff is very slow, and the erosion hazard is slight. In other features, this soil is similar to Placentia sandy loam, 2 to 9 percent slopes.

Included in mapping are small areas of Bonsall soils and Ramona soils.

This Placentia soil is used for irrigated pasture, tomatoes, flowers, and range. Capability unit IIIs-3 (19); Claypan range site.

Placentia sandy loam, thick surface, 2 to 9 percent slopes (PfC).--This soil is gently to moderately sloping, has a 20- to 36-inch surface layer, and has an effective rooting depth of 20 to 36 inches. Fertility is medium. The available water holding capacity is 4 to 5 inches. Runoff is slow to medium, and the erosion hazard slight to moderate. In other features, this soil is similar to Placentia sandy loam, 2 to 9 percent slopes.

Included in mapping are small areas of Bonsall soils and Ramona soils.

This Placentia soil is used for irrigated pasture, tomatoes, flowers, and range. Capability unit IIIs-3 (19); Claypan range site.

Playas

Playas (Py) are essentially barren, level, undrained, closed basins in the Borrego and Ocotillo areas of the desert. Some contain water for short

periods following winter rains. The soil material is clayey or silty and is generally moderately to strongly saline.

This land type is of no value for farming or ranching. Capability unit VIIIw-6 (30).

Ramona Series

The Ramona series consists of well-drained, very deep sandy loams that have a sandy clay loam subsoil. These soils formed in granitic alluvium. They are on terraces and alluvial fans and have slopes of 0 to 30 percent. The elevation ranges from 200 to 1,800 feet. The mean annual precipitation is between 14 and 18 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 260 to 320 days. The winter growing season has light to moderate frost. The vegetation in uncultivated areas is mouse barley, wild oats, filaree, soft chess, chamise, and a few scattered oaks and annual forbs.

In a representative profile the surface layer is yellowish-brown and brown, slightly acid and medium acid sandy loam about 17 inches thick. The subsoil is brown and yellowish-brown slightly acid and neutral sandy clay loam about 43 inches thick. Below this is yellowish-brown, neutral light coarse sandy clay loam. In some areas this soil is gravelly throughout the profile.

Ramona soils are used for dryfarmed crops, citrus, truck crops, tomatoes, flowers, pasture, range, and housing developments.

Ramona sandy loam, 5 to 9 percent slopes (RaC).-- This moderately sloping soil is on terraces and alluvial fans. The slope averages 7 percent.

Representative profile: 2,250 feet west of the northeast corner of sec. 14, T. 13 S., R. 1 E., on Highway 78, 0.1 mile west of Magnolia.

A11--0 to 12 inches, yellowish-brown (10YR 5/4) sandy loam, dark brown (10YR 3/3) moist; weak, medium, subangular blocky structure; soft, very friable, nonsticky, nonplastic; many very fine and fine roots; many very fine tubular pores; slightly acid (pH 6.2); clear, smooth boundary.

A12--12 to 17 inches, brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; weak, coarse, subangular blocky structure; soft, very friable, nonsticky, nonplastic; common very fine and fine roots; many very fine tubular pores; medium acid (pH 6.0); abrupt, smooth boundary.

B21t--17 to 25 inches, brown (7.5YR 5/4) light sandy clay loam, dark brown (7.5YR 4/4) moist; moderate, coarse, angular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine roots; common very fine and fine tubular pores; few thin clay films on ped faces; slightly acid (pH 6.5); clear, wavy boundary.

B22t--25 to 46 inches, brown (10YR 4/4) sandy clay loam, brown (10YR 4/4) moist; moderate, coarse, angular blocky structure; hard, firm, sticky, slightly plastic; common very fine roots; common very fine and fine tubular pores; few thin clay films on ped faces; neutral (pH 6.8); clear, wavy boundary.

B3--46 to 60 inches, yellowish-brown (10YR 5/4) light sandy clay loam, dark brown (10YR 4/3) moist; moderate, coarse, angular blocky structure; hard, friable, slightly sticky, slightly plastic; few very fine roots; common very fine tubular pores, few fine tubular pores; few thin clay films on ped faces and clay bridges; neutral (pH 6.8); gradual, smooth boundary.

C--60 to 74 inches, yellowish-brown (10YR 5/4) light coarse sandy clay loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; few very fine roots; common very fine tubular pores; few clay bridges; neutral (pH 6.8).

The A horizon ranges from yellowish brown or brown to grayish brown in color, is sandy loam to coarse sandy loam in texture, and ranges from 11 to 21 inches in thickness. The B horizon ranges from brown to yellowish brown or dark brown in color, from light sandy clay loam to clay loam in texture, and from 30 to 56 inches in thickness. The C horizon is granitic alluvium that is yellowish-brown to brown light coarse sandy clay loam to sandy loam.

Included with this soil in mapping are small areas of Fallbrook soils, Placentia soils, and Greenfield soils.

Fertility is medium. Permeability is moderately slow. The available water holding capacity is 8.5 to 10.5 inches. Runoff is slow to medium, and the erosion hazard slight to moderate. The rooting depth is more than 60 inches.

This soil is used for dryfarmed crops, irrigated orchards, citrus, truck crops, tomatoes, flowers, pasture, range, and housing developments. Capability unit IIIe-1 (19); Loamy range site.

Ramona sandy loam, 0 to 2 percent slopes (RaA).-- This nearly level soil has a 14- to 24-inch surface layer. Runoff is very slow, and the erosion hazard is slight. In other features, this soil is similar to Ramona sandy loam, 5 to 9 percent slopes.

Included in mapping are small areas of Greenfield soils and Placentia soils.

This Ramona soil is used for citrus, truck crops, tomatoes, flowers, and housing developments. Capability unit I-1 (19).

Ramona sandy loam, 2 to 5 percent slopes (RaB).-- This gently sloping soil has slow runoff and a slight erosion hazard. In other features, it is similar to Ramona sandy loam, 5 to 9 percent slopes.

Included in mapping are small areas of Greenfield soils and Placentia soils.

This Ramona soil is used for citrus, truck crops, tomatoes, flowers, and housing developments. Capability unit IIe-1 (19).

Ramona sandy loam, 5 to 9 percent slopes, eroded (RaC2).--This soil is moderately sloping. Runoff is slow to medium, and the erosion hazard slight to moderate. Sheet and rill erosion have been moderate. In other features this soil is similar to Ramona sandy loam, 5 to 9 percent slopes.

Included in mapping are small areas of Greenfield soils, Placentia soils, and Fallbrook soils.

This Ramona soil is used for citrus, truck crops, tomatoes, flowers, range, and dryfarmed crops. Capability unit IIe-1 (19); Loamy range site.

Ramona sandy loam, 9 to 15 percent slopes, eroded (RaD2).--This soil is strongly sloping. Runoff is medium, and the erosion hazard is moderate. Sheet and rill erosion have been moderate. In other features, this soil is similar to Ramona sandy loam, 5 to 9 percent slopes.

Included in mapping are small areas of Greenfield soils, Placentia soils, and Fallbrook soils.

This Ramona soil is used for citrus, tomatoes, flowers, range, and dryfarmed crops. Capability unit IVe-1 (19); Loamy range site.

Ramona gravelly sandy loam, 9 to 15 percent slopes (RcD).--This strongly sloping soil is 15 to 20 percent gravel. The available water holding capacity is 7 to 9 inches. Runoff is medium, and the erosion hazard moderate. In other features, this soil is similar to Ramona sandy loam, 5 to 9 percent slopes.

Included in mapping are small areas of Greenfield soils, Placentia soils, and Fallbrook soils.

This Ramona soil is used for citrus, tomatoes, flowers, pasture, dryfarmed crops, and range. Capability unit IVe-1 (19); Loamy range site.

Ramona gravelly sandy loam, 15 to 30 percent slopes (RcE).--This moderately steep soil is 15 to 20 percent gravel. The available water holding capacity is 7 to 9 inches. Runoff is medium to rapid, and the erosion hazard moderate to high. In other features, this soil is similar to Ramona sandy loam, 5 to 9 percent slopes.

Included in mapping are small areas of Fallbrook soils and Vista soils. Also included are a few small areas where there are rock outcrops, stones, and cobblestones.

This Ramona soil is used for citrus and range. Capability unit VIe-1 (19); Loamy range site.

Redding Series

The Redding series consists of well-drained, undulating to steep gravelly loams that have a gravelly clay subsoil and a hardpan. These soils formed in old mixed cobbly and gravelly alluvium. They are on dissected terraces and have slopes of 2 to 50

percent. The elevation ranges from 200 to 500 feet. The mean annual precipitation is between 10 and 15 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 290 to 330 days. The vegetation is mainly chamise, flattop buckwheat, sumac, scrub oak, and annual forbs and grasses (pl. IV).

In a representative profile the surface layer is yellowish-brown and light-brown, medium acid and strongly acid gravelly loam about 15 inches thick. The subsoil is yellowish-red and red, very strongly acid gravelly heavy clay loam and gravelly clay. Below this, at a depth of about 30 inches, is an iron-silica cemented hardpan, which is not uniform or continuous. In some areas, the soil is cobbly throughout the profile.

Redding soils are used mainly for military reservations, airfields, urban development, and industrial sites. A small acreage is in range.

Redding gravelly loam, 2 to 9 percent slopes (RdC).--This soil is undulating to gently rolling. The slope averages 3 percent. The topography is hummocky. The broad, low hummocks are locally known as mimamounds.

Representative profile: 950 feet west, 750 feet north of southeast corner of sec. 24, T. 15 S., R. 3 W. (Projected).

A11--0 to 4 inches, yellowish-brown (10YR 5/6) gravelly loam, dark yellowish brown (10YR 4/6) moist; weak, fine, granular structure; slightly hard, very friable, nonsticky, nonplastic; many very fine roots; many very fine tubular pores; 25 percent gravel; medium acid (pH 5.8); clear, smooth boundary.

A12--4 to 15 inches, light-brown (7.5YR 6/4) gravelly loam, brown (7.5YR 5/4) moist; massive; hard, friable, slightly sticky, nonplastic; common very fine and medium roots; many very fine tubular pores; 25 percent gravel; strongly acid (pH 5.5); clear, smooth boundary.

B1--15 to 18 inches, yellowish-red (5YR 5/6) gravelly heavy clay loam, yellowish red (5YR 4/6) moist; moderate, medium, angular blocky structure; very hard, firm, sticky, plastic; common very fine and fine roots; common very fine tubular pores; common thick clay films; 25 percent gravel; very strongly acid (pH 4.5); very abrupt, smooth boundary.

B2t--18 to 30 inches, red (2.5YR 4/6) gravelly clay, dark red (2.5YR 3/6) moist; strong, medium, angular blocky structure; very hard, firm, sticky, plastic; common very fine and fine roots; common very fine tubular pores; many thick clay films on ped faces; 25 percent gravel; very strongly acid (pH 4.5); abrupt, smooth boundary.

Cm--30 to 45 inches, yellowish-red (5YR 5/6), reticulate indurated hardpan, yellowish red (5YR 4/6) moist; massive; no roots; few fine tubular pores; extremely acid (pH 4.2); abrupt, smooth boundary.

This mapping unit has a wide range in soil characteristics. The landscape is one of well drained to moderately well drained mimamounds and intervening poorly drained swales. During rainy periods, water is frequently ponded in pools between the mounds. The surface layer, the bleached subsurface layer, the subsoil, and the hardpan all vary noticeably in color and thickness. In places the bleached subsurface layer, the subsoil, or the hardpan is lacking.

The A1 horizon ranges from yellowish brown or reddish brown to grayish brown in color, from gravelly loam to gravelly sandy loam in texture, and from 3 to 6 inches in thickness. The A2 horizon occurs in most areas. It ranges from 8 to 14 inches in thickness, ranges from gravelly loam to gravelly sandy loam in texture, and has colors of pink, light brown, or pale brown. The A horizon is 20 to 30 percent gravel. The B1 and B2t horizons range from 12 to 21 inches in thickness, have colors of yellowish red or red to dark red to reddish brown, grayish brown, or gray, and range from cobbly clay or gravelly clay to gravelly heavy clay loam in texture. The B horizon is 20 to 30 percent gravel. It is very strongly acid. Depth to the iron-silica hardpan ranges from 23 to 41 inches. In many places there are holes or windows in the hardpan 4 to 20 feet in diameter. The surface layer on the mimamounds is very thick. Gray colors, a thin surface layer, and a thick subsoil occur in the intermound areas.

Included with this soil in mapping are small areas of Olivenhain soils, Huerhuero soils, and Chesterton soils.

Fertility is low. The available water holding capacity is 1.5 to 2.5 inches. Permeability is very slow; the hardpan is almost impervious. Runoff is slow to medium, and the erosion hazard slight to moderate. The rooting depth is 13 to 26 inches; roots are restricted by the clay subsoil.

This soil is used for military reservations, air fields, urban development, range, and industrial sites. Capability unit VIe-3 (19); Acid Claypan range site.

Redding cobbly loam, 9 to 30 percent slopes (ReE).--This strongly sloping to moderately steep soil is 10 to 20 inches deep over a hardpan. There are very few hummocks. Cobblestones make up 20 to 30 percent of the surface layer and 25 to 35 percent of the subsoil. The available water holding capacity is 1.5 to 2 inches. Runoff is medium to rapid, and the erosion hazard moderate to high. In other features, this soil is similar to Redding gravelly loam, 2 to 9 percent slopes.

Included in mapping are small areas of Olivenhain soils and Huerhuero soils.

This Redding soil is used for military reservations and range. A few small areas are used for housing developments. Capability unit VIe-7 (19); Acid Claypan range site.

Redding cobbly loam, dissected, 15 to 50 percent slopes (RfF).--This moderately steep to steep soil is 10 to 18 inches deep over a hardpan. The

landscape is characterized by many, narrow, tortuous divides, V-shaped valley bottoms, and steep side slopes. There are no hummocks. The clay subsoil and hardpan are lacking in a few areas adjacent to the valley bottoms and along the entrenched side-slope drainageways. The surface layer is 20 to 30 percent cobblestones, and the subsoil 25 to 35 percent. The available water holding capacity is 1.5 to 2 inches. Runoff is medium to rapid, and the erosion hazard moderate to high. In other features, this soil is similar to Redding gravelly loam, 2 to 9 percent slopes.

Included in mapping are small areas of Olivenhain soils.

This Redding soil is used for military reservations and for limited grazing and range. Capability unit VIIe-7 (19); Acid Claypan range site.

Redding-Urban land complex, 2 to 9 percent slopes (RhC).--This complex occurs on marine terraces, at elevations of 200 to 500 feet. The landscape has been altered through cut and fill operations and leveling for building sites. Before cut and fill operations and leveling, the slope was 2 to 9 percent.

The material exposed in the cuts is a cobbly hardpan. The material in the fills is a mixture of cobbly and gravelly loam and clay. Cuts and fills should be determined by onsite investigation. Between the leveled building sites are moderately steep escarpments that are easily eroded.

The entire acreage is used for homesites.

Redding-Urban land complex, 9 to 30 percent slopes (RhE).--This complex occurs on marine terraces, at elevations of 200 to 500 feet. The landscape has been altered through cut and fill operations and leveling for building sites. Before cut and fill operations and leveling, the slope was 9 to 30 percent.

The material exposed in the cuts is a cobbly hardpan. The material in the fills is a mixture of cobbly and gravelly loam and clay. Cuts and fills should be determined by onsite investigation. Between the leveled building sites are very steep escarpments that are easily eroded.

The entire acreage is used for homesites.

Reiff Series

The Reiff series consists of well-drained, very deep fine sandy loams that formed in alluvium derived from granitic rock. These soils are on alluvial fans and alluvial plains and have slopes of 0 to 9 percent. The elevation ranges from 200 to 1,900 feet. The mean annual precipitation is between 14 and 17 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 260 to 320 days. The winter growing season has light to moderate frost. Soft chess, wild oats, filaree, mustard, and chamise is the chief vegetation in uncultivated areas.

In a representative profile, the surface layer is grayish-brown and brown, slightly acid and neutral fine sandy loam about 14 inches thick. The next layers are brown, mildly alkaline and moderately alkaline fine sandy loam and sandy loam. This material extends to a depth of more than 60 inches.

Reiff soils are used mainly for avocados, citrus, truck crops, tomatoes, flowers, and field crops.

Reiff fine sandy loam, 0 to 2 percent slopes (RkA).--This nearly level soil is on alluvial fans and alluvial plains. The slope averages 2 percent.

Representative profile: Approximately 80 feet south of Escondido Creek and 25 feet west of Midway Drive, SE 1/4 of SE 1/4 sec. 11, T. 12 S., R. 2 W.

Ap--0 to 6 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak, fine, subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many very fine and fine roots; slightly acid (pH 6.3); clear, wavy boundary.

A1--6 to 14 inches, brown (10YR 5/3) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, subangular blocky structure; hard, friable, slightly sticky, slightly plastic; many very fine roots, many very fine tubular pores; neutral (pH 7.0); abrupt, smooth boundary.

AC--14 to 27 inches, brown (10YR 5/3) fine sandy loam, very dark grayish brown (10YR 3/2) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; many micro and very fine roots, few fine roots; common very fine tubular pores; mildly alkaline (pH 7.5); gradual, smooth boundary.

C1--27 to 43 inches, brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; massive; slightly hard, very friable, slightly sticky, slightly plastic; many micro and very fine roots; many very fine tubular pores, few fine tubular pores; slightly effervescent, moderately alkaline (pH 8.0); gradual, smooth boundary.

C2--43 to 60 inches, brown (10YR 4/3) sandy loam, dark brown (10YR 3/3) moist; massive; soft, very friable, slightly sticky, slightly plastic; common very fine roots; common very fine tubular pores; moderately alkaline (pH 8.0).

The A horizon ranges from grayish brown to brown in color, is fine sandy loam, sandy loam, or loam in texture, and ranges from 9 to 19 inches in thickness. The AC horizon ranges from brown to grayish brown in color, from sandy loam or fine sandy loam to loam in texture, and from 9 to 17 inches in thickness. The C horizon ranges from brown to grayish brown in color and from loam to sandy loam in texture. It extends to a depth of more than 60 inches.

Included with this soil in mapping are small areas of Visalia soils, Ramona soils, and Placentia soils.

Fertility is medium to high. Permeability is moderately rapid. The available water holding capacity is 7.5 to 9.5 inches. Runoff is very slow, and the erosion hazard is slight. The rooting depth is more than 60 inches.

This soil is used mostly for avocados, citrus, truck crops, tomatoes, flowers, field crops, orchards, and pasture. A few small areas in Land Resource Area 19 are used for housing developments. In Land Resource Area 20, this soil is used for pasture. Capability unit I-1 (19); IIIC-1 (20).

Reiff fine sandy loam, 2 to 5 percent slopes (RkB).--This soil is gently sloping and has an effective rooting depth of 60 inches. Runoff is slow, and the erosion hazard slight. In other features, this soil is similar to Reiff fine sandy loam, 0 to 2 percent slopes.

Included in mapping are small areas of Visalia soils, Ramona soils, and Placentia soils.

In Land Resource Area 19, this Reiff soil is used for avocados, citrus, truck crops, tomatoes, flowers, field crops, orchards, and pasture. In Land Resource Area 20, it is used for pasture. Capability unit IIe-1 (19), IIIe-1 (20).

Reiff fine sandy loam, 5 to 9 percent slopes (RkC).--This soil is moderately sloping. Runoff is slow to medium, and the erosion hazard slight to moderate. In other features, this soil is similar to Reiff fine sandy loam, 0 to 2 percent slopes.

Included in mapping are small areas of Visalia soils, Ramona soils, and Placentia soils.

In Land Resource Area 19, this soil is used for avocados, citrus, truck crops, tomatoes, flowers, orchards, and pasture. In Land Resource Area 20, it is used for pasture, Capability unit IIe-1 (19), IIIe-1 (20).

Riverwash

Riverwash (Rm) occurs in intermittent stream channels. The material is typically sandy, gravelly, or cobbly. It is excessively drained and rapidly permeable. Many areas are barren. Scattered sycamores and coast live oaks grow along the banks. Sparse shrubs and forbs occur in patches.

This land type is of no value for farming or ranching. In many places it is used as a source of sand and gravel. Capability unit VIIIw-4 (19, 20, 30).

Rositas Series

The Rositas series consists of somewhat excessively drained, very deep loamy coarse sands derived from granitic alluvium. These soils are on alluvial fans and alluvial plains and have slopes of 0 to 15 percent. The elevation ranges from 100 to 2,000 feet. The mean annual precipitation is between 4 and 7 inches, and the mean annual air temperature between 70° and 74° F. The frost-free

season is about 210 to 240 days. The vegetation is chiefly ocotillo, cholla, creosotebush, saltbush, and annual grasses.

In a representative profile, the surface layer is light brownish-gray, mildly alkaline loamy coarse sand about 5 inches thick. The next layer is pale-brown, moderately alkaline fine gravelly loamy coarse sand. This layer is slightly calcareous and extends to a depth of more than 60 inches.

Rositas soils are used for desert range, grapes, citrus, alfalfa, and pasture.

Rositas loamy coarse sand, 2 to 9 percent slopes (RsC).--This gently to moderately sloping soil occurs on alluvial fans. The slope averages 5 percent.

Representative profile: 180 feet east, 50 feet south of NW corner of sec. 18, T. 14 S., R. 6 E.

A1--0 to 5 inches, light brownish-gray (10YR 6/2) loamy coarse sand, dark grayish brown (10YR 4/2) moist; weak, fine, granular structure; soft, very friable, nonsticky, nonplastic; very few medium roots, few fine and very fine roots; common very fine discontinuous pores, few fine discontinuous pores; mildly alkaline (pH 7.5); clear, smooth boundary.

C--5 to 60 inches, pale-brown (10YR 6/3) fine gravelly loamy coarse sand, dark brown (10YR 4/3) moist; massive; soft, very friable, nonsticky, nonplastic; very few fine and very fine roots; very few very fine discontinuous pores; 25 percent gravel; moderately alkaline (pH 8.0), slightly effervescent.

The A horizon ranges from light brownish gray to pale brown or very pale brown in color, from loamy coarse sand or fine sand to sand in texture, and from 3 to 8 inches in thickness. The C horizon extends to a depth of more than 60 inches. It ranges from pale brown to very pale brown or light yellowish brown in color and from gravelly coarse sand to loamy fine sand in texture. It is 0 to 25 percent gravel.

Included with this soil in mapping are small areas of Carrizo soils, Mecca soils, and Indio soils.

Fertility is low. Permeability is rapid. The available water holding capacity is 3 to 4 inches. Runoff is slow to medium, and the erosion hazard is slight. The rooting depth is more than 60 inches.

This soil is generally used for desert range. Capability unit IVs-4 (30); Sandy range site.

Rositas fine sand, 0 to 2 percent slopes (RoA).--This soil is nearly level. Its surface layer has been reworked by wind. Runoff is very slow. The erosion hazard is moderate. In other features, this soil is similar to Rositas loamy coarse sand, 2 to 9 percent slopes.

Included in mapping are small areas of Carrizo soils, Mecca soils, and Indio soils. Also included is about 1,800 acres where the soil is gently sloping.

This Rositas soil is used for vineyards, citrus, and desert range. Moderate sand abrasion frequently damages seedlings in spring. Capability unit IVe-4 (30); Sandy range site.

Rositas fine sand, hummocky, 5 to 9 percent slopes (RrC).--This soil is gently rolling and has hummocks to low dunes that are less than 6 feet high. Runoff is slow to medium. The hazard of water erosion is slight to moderate. The hazard of wind erosion is high. In other features, this soil is similar to Rositas loamy coarse sand, 2 to 9 percent slopes.

Included in mapping are small areas of Carrizo soils, Mecca soils, and Indio soils. Also included are two small areas of silt dunes north of Ocotillo.

This Rositas soil is used for desert range. Capability unit VIIe-4 (30); Sandy range site.

Rositas loamy coarse sand, 0 to 2 percent slopes (RsA).--This soil is nearly level. Runoff is very slow, and the erosion hazard is slight. In other features, this soil is similar to Rositas loamy coarse sand, 2 to 9 percent slopes.

Included in mapping are small areas of Carrizo soils, Mecca soils, and Indio soils.

This Rositas soil is used mainly for desert range. In a few small areas where water is available, it is used for alfalfa and pasture. Capability unit IVs-4 (30); Sandy range site.

Rositas loamy coarse sand, 9 to 15 percent slopes (RsD).--This soil is strongly sloping. Runoff is medium, and the erosion hazard moderate. In other features, this soil is similar to Rositas loamy coarse sand, 2 to 9 percent slopes.

Included in mapping are small areas of Carrizo soils, Mecca soils, and Indio soils.

This Rositas soil is used for desert range. Capability unit VIIs-4 (30); Sandy range site.

Rough Broken Land

Rough broken land (RuG) is made up of well-drained to excessively drained, steep and very steep land dissected by many narrow V-shaped valleys and sharp tortuous divides. Areas of exposed raw sediments are common, and there are a few areas of very shallow soils. Runoff is rapid to very rapid, and erosion is very high. The vegetation is a sparse cover of low woody shrubs.

This land type is of no value for farming or ranching. Capability unit VIIIE-1 (19, 20).

Salinas Series

The Salinas series consists of well drained and moderately well drained clay loams that formed in sediments washed from Diablo, Linne, Las Flores, Huerhuero, and Olivenhain soils. These soils are on flood plains and alluvial fans and have slopes of 0 to 9 percent. The elevation ranges from 25 to 300

feet. The mean annual precipitation is between 10 and 12 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 300 to 340 days. The winter growing season has only light frost. In uncultivated areas, the vegetation is chiefly annual grasses and forbs and scattered trees and shrubs.

In a representative profile the surface layer is dark grayish-brown, neutral and mildly alkaline clay loam about 22 inches thick. The next layers are very dark grayish-brown, mildly alkaline and moderately alkaline, calcareous clay loam about 24 inches thick. The substratum is dark-brown, moderately alkaline, calcareous clay loam and loam. It extends to a depth of more than 60 inches. In some areas the surface layer is clay.

Salinas soils are used for citrus, truck crops, tomatoes, flowers, and small pasture lots.

Salinas clay loam, 0 to 2 percent slopes (SbA).--This soil is in small drainageways or in the center of relatively large valleys. The slope averages 2 percent.

Representative profile: 500 feet south and 600 feet east of the west quarter corner of sec. 20, T. 18 S., R. 1 W.

Ap--0 to 7 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, subangular blocky structure; very hard, friable, slightly sticky, slightly plastic; noncalcareous; neutral (pH 7.2); abrupt, smooth boundary.

A1--7 to 22 inches, dark grayish-brown (10YR 4/2) heavy clay loam and clay, very dark grayish brown (10YR 3/2) moist; weak, coarse, prismatic and weak, medium, angular blocky structure; very hard, firm, sticky, plastic; common fine and very fine roots; noncalcareous; mildly alkaline (pH 7.4); clear, wavy boundary.

C1--22 to 32 inches, very dark grayish-brown (10YR 3/2) heavy clay loam; very dark brown (10YR 2/2) moist; weak, coarse, prismatic and weak, medium, angular blocky structure; very hard, firm, sticky, plastic; few very fine roots; few fine lime mottles that are slightly to strongly effervescent; mildly alkaline (pH 7.8); gradual, smooth boundary.

C2--32 to 46 inches, very dark grayish-brown (10YR 3/2) clay loam, very dark brown (10YR 2/2) moist; weak, coarse and very coarse, prismatic structure; very hard, friable, slightly sticky, slightly plastic; very few fine roots; few fine lime mottles that are slightly and strongly effervescent; moderately alkaline (pH 7.9); abrupt, wavy boundary.

IIC3ca--46 to 55 inches, dark-brown (10YR 4/3) clay loam, very dark brown (10YR 3/3) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; few large lime mottles; moderately alkaline (pH 7.9); clear, smooth boundary.

IIC4ca--55 to 64 inches, dark-brown (10YR 4/3) heavy loam, very dark brown (10YR 3/3) moist; massive; slightly hard, friable, slightly sticky, nonplastic; many large lime mottles; moderately alkaline (pH 8.0).

The A horizon ranges from dark grayish brown to dark gray in color and from 20 to 25 inches in thickness. The C1 and C2 horizons range from very dark grayish brown to dark grayish brown in color, from clay loam to clay in texture, and from 19 to 29 inches in thickness. The IIC horizon ranges from brown to dark brown in color and from clay loam to heavy loam in texture. It extends to a depth of more than 60 inches. The C and IIC horizons have lime filaments ranging from few to many. Cobblestones and gravel occur in the surface layer adjacent to drainageways.

Included with this soil in mapping are small areas of Diablo soils, Huerhuero soils, and Tujunga soils.

Fertility is high. Drainage is good, and permeability is moderately slow. The available water holding capacity is 10 to 11.5 inches. Runoff is very slow, and the erosion hazard is slight. The rooting depth is 60 inches or more.

This soil is used for citrus, truck crops, tomatoes, flowers, and small pasture lots. Capability unit I-1 (19).

Salinas clay loam, 2 to 9 percent slopes (SbC).--This soil is gently to moderately sloping. Runoff is slow to medium, and the erosion hazard slight to moderate. In other features, this soil is similar to Salinas clay loam, 0 to 2 percent slopes.

Included in mapping are small areas of Diablo soils, Huerhuero soils, and Tujunga soils.

This Salinas soil is used for citrus, truck crops, tomatoes, flowers, and pasture. Capability unit IIe-1 (19).

Salinas clay, 0 to 2 percent slopes (ScA).--This soil is nearly level. It has a surface layer of clay and a substratum of clay to clay loam. Drainage is moderately good. Permeability is slow. The available water holding capacity is 7.5 to 10 inches. Runoff is very slow, and the erosion hazard is slight. In other features, this soil is similar to Salinas clay loam, 0 to 2 percent slopes.

Included in mapping are small areas of Diablo soils, Huerhuero soils, and Tujunga soils.

This Salinas soil is used for tomatoes and pasture. Capability unit IIs-5 (19).

Salinas clay, 2 to 5 percent slopes (ScB).--This soil is gently sloping. It has a surface layer of clay and a substratum of clay to clay loam. Drainage is moderately good. Permeability is slow. The available water holding capacity is 7.5 to 10 inches. Runoff is slow, and the erosion hazard slight. In other features, this soil is similar to Salinas clay loam, 0 to 2 percent slopes.

Included in mapping are small areas of Diablo soils, Huerhuero soils, and Tujunga soils.

This Salinas soil is used for tomatoes and pasture. Capability unit IIe-5 (19).

San Miguel Series

The San Miguel series consists of well-drained, shallow to moderately deep silt loams that have a clay subsoil. These soils are derived from metavolcanic rock. They are in mountainous areas and have slopes of 9 to 30 percent. The elevation ranges from 700 to 3,300 feet. The mean annual precipitation is between 13 and 18 inches, and the mean annual air temperature between 59° and 62° F. The frost-free season is 240 to 280 days. The vegetation is chiefly chamise, ceanothus, and sumac. A small amount of filaree, soft chess, and wild oats occurs as an understory.

In a representative profile, the surface layer is light yellowish-brown and very pale brown, medium acid and strongly acid silt loam about 8 inches thick. The subsoil is strong-brown and yellowish-brown, strongly acid and very strongly acid clay and gravelly clay. At a depth of about 23 inches is hard metavolcanic rock. Rocks cover about 10 percent of the surface.

The San Miguel soils are used for limited range and for watershed and wildlife habitat.

San Miguel rocky silt loam, 9 to 30 percent slopes (SmE).--This soil is strongly sloping to moderately steep. The slope averages 30 percent. Rock outcrop covers about 10 percent of the surface.

Representative profile: On private road on west side of Otay Mountain, SW 1/4 of SW 1/4 sec. 27, T. 19 S., R. 1 E.

A1--0 to 4 inches, light yellowish-brown (10YR 6/4) silt loam, brown (7.5YR 4/4) moist; massive; slightly hard, friable, nonsticky, nonplastic; common very fine roots; common fine pores; medium acid (pH 6.0); abrupt, wavy boundary.

A2--4 to 8 inches, very pale brown (10YR 7/3) silt loam, yellowish brown (10YR 5/6) moist; massive; hard, friable, nonsticky, slightly plastic; common fine and medium roots; many fine and very fine pores; few continuous clay films in pores; strongly acid (pH 5.2); abrupt, wavy boundary.

B2lt--8 to 18 inches, strong-brown (7.5YR 5/6) clay, yellowish red (5YR 4/6) moist; strong, coarse, prismatic structure; extremely hard, firm, very sticky, very plastic; few and common fine and medium roots; few fine and medium pores; many moderately thick clay films on ped faces; few slickensides; strongly acid (pH 5.1); clear, wavy boundary.

B22t--18 to 23 inches, yellowish-brown (10YR 5/4) gravelly clay, brown (7.5YR 4/4) moist; moderate, medium, subangular blocky structure; very hard, friable, very sticky, plastic; common fine and very fine roots; few fine pores; common moderately thick clay films on

coarse fragments; 20 percent gravel; very strongly acid (pH 5.0); abrupt, irregular boundary.

R--23 inches, gray to dark-gray hard metavolcanic rock; cleavage planes intersect near right angles; uppermost 2 or 4 inches is weathered to light yellowish brown (2.5Y 6/4); small amount of yellowish-brown soil in cracks; many feet thick.

The A horizon ranges from light yellowish brown or very pale brown to brown in color, from silt loam to loam in texture, and from 3 to 16 inches in thickness. The B2t horizon ranges from strong brown or yellowish brown to reddish brown or yellowish red in color, from clay or silty clay loam to clay loam in texture, and from 12 to 24 inches in thickness. The gravel content is 5 to 20 percent. The depth to hard rock ranges from 15 to 34 inches.

Included with this soil in mapping are small areas of Escondido soils, Exchequer soils, and Friant soils. Also included are areas where the slope is as much as 50 percent.

Fertility is very low. Permeability is slow. The available water holding capacity is 2.5 to 3 inches; some moisture is available from the clay subsoil. Runoff is medium to rapid, and the erosion hazard moderate to high. The rooting depth is 15 to 34 inches.

This soil is used for watershed and wildlife habitat and for limited range. Capability unit VIIe-8 (19); Acid Claypan range site.

San Miguel-Exchequer rocky silt loams, 9 to 70 percent slopes (SnG).--This complex occurs on mountainous uplands, at elevations of 400 to 3,300 feet. It is about 50 percent San Miguel silt loam and 40 percent Exchequer silt loam. About 10 percent of the area is covered by rock outcrop.

Included in mapping were small areas of Escondido soils and Friant soils.

The San Miguel soil has a surface layer of light-brown silt loam about 8 inches thick. The subsoil is strong-brown and yellowish-brown clay underlain at a depth of about 23 inches by hard metavolcanic rock. Detailed information is given in the description of San Miguel rocky silt loam, 9 to 30 percent slopes.

The Exchequer soil has a surface layer of yellowish-red silt loam about 10 inches thick, and below this, hard metabasic rock. Detailed information about this soil is given in the description of Exchequer rocky silt loam, 30 to 70 percent slopes, under the heading "Exchequer Series."

San Miguel silt loam is slowly permeable in the subsoil and has 2.5 to 3 inches of water available in the 18 to 23 inches of effective rooting depth.

Exchequer silt loam is moderately permeable and has 1 to 2 inches of water available in the 8 to 17 inches of effective rooting depth.

For both soils fertility is very low, drainage is good, runoff is medium to rapid, and the erosion hazard is moderate to very high.

These soils are used chiefly for wildlife habitat and watershed. Both are in capability unit VIIe-8

(19). The San Miguel soil is in the Acid Claypan range site, and the Exchequer soil is in the Shallow Loamy range site.

Sheephead Series

The Sheephead series consists of well-drained, shallow fine sandy loams that formed in material weathered from micaceous schist and gneiss. These soils are on mountainous uplands and have slopes of 9 to 65 percent. The elevation ranges from 3,000 to 6,000 feet. The mean annual precipitation is between 20 and 30 inches, and the mean annual air temperature between 56° and 58° F. The frost-free season is 160 to 185 days. The vegetation is chiefly chamise, manzanita, and a few annual grasses.

In a representative profile, the surface layer is dark grayish-brown and brown, slightly acid, micaceous cobbly fine sandy loam about 8 inches thick. The next layer is fractured foliar mica schist and light yellowish-brown medium acid very stony fine sandy loam that grades to micaceous schist or gneiss at a depth of about 51 inches. Rock outcrop covers about 10 percent of the area.

Sheephead soils are used for limited range, wildlife habitat, and watershed.

Sheephead rocky fine sandy loam, 30 to 65 percent slopes, eroded (SpG2).--This steep to very steep soil occurs in mountainous areas. Slopes are dominantly 40 percent. Rock outcrop covers about 10 percent of the area.

Representative profile: 800 feet east of Sunrise Highway, about 10 miles southeast of Julian in the southwest quarter of sec. 7, T. 14 S., R. 5 E.

A11--0 to 4 inches, dark grayish-brown (10YR 4/2), cobbly, highly micaceous fine sandy loam, dark brown (10YR 3/3) moist; weak, very fine, crumb structure; soft, very friable, nonsticky, nonplastic; many very fine roots; 20 percent cobblestones; slightly acid (pH 6.5); clear, smooth boundary.

A12--4 to 8 inches, brown (10YR 5/3), cobbly, highly micaceous fine sandy loam, dark brown (10YR 3/3) moist; weak, fine, crumb structure; soft, friable, nonsticky, nonplastic; many fine roots; common fine tubular pores; 20 percent cobblestones; slightly acid (pH 6.2); clear, irregular boundary.

C--8 to 51 inches, fractured foliar micaceous schist and light yellowish-brown (10YR 6/4), angular very stony fine sandy loam, yellowish brown (10YR 5/4) moist; massive; soft, friable, nonsticky, nonplastic; common medium and coarse roots; 55 percent stones; medium acid (pH 6.0); diffuse, irregular boundary.

R--51 inches, pale-yellow (2.5Y 7/4), fractured foliar micaceous schist; yellowish brown (10YR 5/4) moist; yellowish red (5YR 4/8) clay films on rock fragments; few coarse roots; medium acid (pH 6.0); many feet thick.

The A horizon ranges from dark grayish brown or brown to grayish brown in color, from highly micaceous fine sandy loam to loamy fine sand in texture, and from 6 to 16 inches in thickness. This horizon is 15 to 25 percent gravel, cobblestones, or stones. The C horizon ranges from light yellowish brown to yellowish brown or dark yellowish brown in color, from fine sandy loam to loamy sand in texture, and from 14 to 48 inches in thickness. This horizon is 35 to 75 percent coarse fragments of micaceous schist or gneiss.

Included with this soil in mapping are small areas of Tollhouse soils, La Posta soils, and Holland soils.

Fertility is low. Permeability is moderately rapid. The available water holding capacity is 2 to 3 inches. Limited amounts of water and nutrients are available in the upper part of the C horizon. The rooting depth is 20 to 55 inches. Runoff is rapid to very rapid, and the erosion hazard high to very high. Sheet erosion has been moderate.

This soil is used for limited range, wildlife habitat, and watershed. Capability unit VIIe-7 (20); Loamy range site.

Sheephead rocky fine sandy loam, 9 to 30 percent slopes, eroded (SpE2).--This soil is strongly sloping to moderately steep. Runoff is medium to rapid, and the erosion hazard moderate to high. Sheet erosion has been moderate. In other features, this soil is similar to Sheephead rocky fine sandy loam, 30 to 65 percent slopes.

Included in mapping are small areas of Tollhouse soils, La Posta soils, and Holland soils.

This Sheephead soil is used for limited range, wildlife habitat, and watershed. Capability unit VIe-7 (20); Loamy range site.

Sloping Gullied Land

Sloping gullied land (SrD) occurs in the desert on alluvial fans adjacent to mountains. It consists of a wide variety of material derived from igneous, sedimentary, and metamorphic rocks. The texture ranges from clay loam to gravelly, cobbly sand. Limy material has been exposed where gullies have dissected areas of old alluvium. Drainage is good to somewhat excessive. Runoff is medium to very rapid, and the erosion hazard is moderate to high. The vegetation is a very sparse cover of desert shrubs, cactus, and annual forbs and grasses.

Included in mapping is about 750 acres of steep talus slopes and fans below basalt ledges in the vicinity of Jacumba. The soils are shallow to moderately deep gravelly and cobbly clay loams and loams. They are underlain by basalt, volcanic tuff, and gravel.

Sloping gullied land is used for wildlife habitat and watershed. Capability unit VIIIE-1 (30).

Soboba Series

The Soboba series consists of excessively drained, very deep stony loamy sands derived from gravelly and

stony, acid, igneous alluvium. These soils are on alluvial fans and have slopes of 9 to 30 percent. The elevation ranges from 800 to 2,000 feet. The mean annual precipitation is between 12 and 18 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 270 to 310 days. The winter growing season has only light frost. The vegetation is chiefly flattop buckwheat, mustard, and California sagebrush.

In a representative profile, the surface layer is grayish-brown, neutral stony loamy sand about 12 inches thick. The next layer is grayish-brown, neutral very stony loamy sand. It extends to a depth of more than 60 inches.

Soboba soils are used mainly for avocado orchards and range.

Soboba stony loamy sand, 9 to 30 percent slopes (SsE).--This strongly sloping to moderately steep soil is on alluvial fans. Slopes are dominantly 10 percent.

Representative profile: 100 feet southwest of Nathan Harrison Grade Road, 0.4 mile northeast of Highway 76, SW 1/4 of SE 1/4 sec. 9, T. 10 S., R. 1 W.

C1--0 to 12 inches, grayish-brown (2.5Y 5/2) stony loamy sand, dark grayish brown (2.5Y 4/2) moist; single grain, loose; nonsticky, nonplastic; many very fine roots, common fine roots; 20 percent stones; neutral (pH 7.0); clear, smooth boundary.

C2--12 to 60 inches, grayish-brown (2.5Y 5/2) very stony loamy sand, dark grayish brown (2.5Y 4/2) moist; single grain, loose; nonsticky, nonplastic; many very fine roots, common fine and medium roots; 40 percent stones; neutral (pH 6.7).

The C1 horizon ranges from brown to grayish brown in color, from loamy sand to sandy loam in texture, and from 10 to 15 inches in thickness. This horizon is 20 to 25 percent stones, cobblestones, and gravel. The C2 horizon extends to a depth of more than 60 inches. It ranges from grayish brown to brown or pale brown in color and from loamy sand to sandy loam in texture. This horizon is 35 to 45 percent stones, cobblestones, and gravel.

Included with this soil in mapping are small areas of Tujunga soils, Visalia soils, and Vista soils.

Fertility is low. Permeability is very rapid. The available water holding capacity is 2.5 to 3.5 inches. Runoff is medium to rapid, and the erosion hazard moderate to high. The rooting depth is 60 inches.

This soil is used for avocado orchards and range. Capability unit VIe-7 (20); Sandy range site.

Steep Gullied Land

Steep gullied land (StG) consists of strongly sloping to steep areas that are actively eroding into old alluvium or decomposed rock. It occurs as

large individual gullies or as a network of many gullies in areas where the vegetative cover is sparse or has been severely depleted by grazing or fires. The vegetation is a sparse cover of shrubs and annual grasses and forbs. Runoff is very rapid, and the erosion hazard very high. Capability unit VIIIE-1 (19, 20).

Stockpen Series

The Stockpen series consists of moderately well drained, moderately deep gravelly clay loams. These soils are on marine terraces and have slopes of 0 to 5 percent. The elevation ranges from 100 to 400 feet. The mean annual precipitation is between 10 and 12 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 320 to 340 days. The winter growing season has only light frost. The vegetation is chiefly annual and perennial grasses and forbs.

In a representative profile, the surface layer is light-gray, slightly acid gravelly clay loam about 3 inches thick. The subsoil is gray, mildly alkaline and moderately alkaline and calcareous gravelly clay and clay about 31 inches thick. The substratum is olive-gray, moderately alkaline clay.

Stockpen soils are used for truck crops, tomatoes, and flowers.

Stockpen gravelly clay loam, 0 to 2 percent slopes (SuA).--This nearly level soil is on marine terraces. Slopes are dominantly 1 percent. Low broad-based hummocks, locally called mimamounds, occur in undisturbed areas.

Representative profile: About 6 miles northeast of San Ysidro, approximately 450 feet east of the northwest corner of sec. 26, T. 18 S., R. 1 W.

A2--0 to 3 inches, light-gray (10YR 7/1) gravelly clay loam, gray (10YR 5/1) moist; massive; hard, friable, slightly sticky, plastic; many very fine roots; many fine tubular pores; 15 percent gravel; slightly acid (pH 6.5); abrupt, smooth boundary. The uppermost quarter inch is slightly darker in color and coarser in texture than the rest of the horizon.

B21t--3 to 13 inches, gray (10YR 5/1) gravelly clay, dark gray (10YR 4/1) moist; strong, medium, columnar structure; extremely hard, firm, very sticky, very plastic; common fine exped roots; few fine tubular pores; continuous, thick clay films on ped faces; 15 percent gravel; mildly alkaline (pH 7.8); gradual, smooth boundary.

B22t--13 to 21 inches, gray (10YR 5/1) gravelly clay, dark gray (10YR 4/1) moist; somewhat less gravel than in B21t horizon; strong, coarse, angular blocky structure; extremely hard, firm, very sticky, very plastic; few fine exped roots; few fine tubular pores; continuous, thick clay films on ped faces; 15

percent gravel; moderately alkaline (pH 8.0); gradual, smooth boundary.

B3ca--21 to 34 inches, gray (10YR 5/1) clay, dark gray (2.5Y 4/1) moist; small amount of angular gravel; strong, coarse, angular blocky structure; extremely hard, firm, sticky, very plastic; many fine tubular pores; continuous thick clay films on ped faces; lime segregated in medium, rounded, soft masses; strongly effervescent, moderately alkaline (pH 8.0); gradual, smooth boundary.

C--34 to 60 inches, olive-gray (5Y 5/2) clay, gray (5Y 5/1) moist; moderate, coarse, angular blocky structure; hard, firm, sticky, very plastic; common fine tubular pores; moderately alkaline (pH 8.0).

The A2 horizon ranges from light gray to gray in color, from gravelly clay loam to gravelly loam in texture, and from 1 to 5 inches in thickness. The gravel content is 5 to 20 percent. The B horizon ranges from gray to grayish brown or dark gray in color, from gravelly clay to clay in texture, and from 24 to 46 inches in thickness. The gravel content is 15 to 20 percent. The depth to the C horizon ranges from 25 to 51 inches. In places gypsum occurs as crystals in the upper part of the C horizon, especially beneath gravel and rock fragments.

Included with this soil in mapping are small areas of Diablo soils, Huerhuero soils, and Salinas soils.

Fertility is medium Permeability is very slow. The available water holding capacity is 3 to 5 inches; some moisture is available from the clay subsoil. Runoff is very slow, and the erosion hazard is slight. The rooting depth is 25 to 36 inches.

This soil is used for truck crops, tomatoes, and flowers. Capability unit IIIs-3 (19).

Stockpen gravelly clay loam, 2 to 5 percent slopes (SuB).--This soil is gently sloping. Runoff is slow, and the erosion hazard is slight. In other features, this soil is similar to Stockpen gravelly clay loam, 0 to 2 percent slopes.

Included in mapping are small areas of Diablo soils, Huerhuero soils, and Salinas soils.

This Stockpen soil is used for truck crops, tomatoes, and flowers. Capability unit IIIs-3 (19).

Stony Land

Stony land (SvE) occurs at the base of cliffs or below steep rocky slopes. It is strongly sloping to very steep. The material consists of many stones, boulders, and cobblestones, and some finer material. In many places there are large boulders 3 to 6 feet in diameter on the surface. The vegetation is mostly brush and a few scattered oak trees.

Included in mapping are areas of basic extrusive rocks and narrow valleys on Miramar Mesa that have deposits of boulders and cobblestones.

Stony land is used for watershed and wildlife habitat. Capability unit VIIIs-1 (19, 20).

Terrace Escarpments

Terrace escarpments (TeF) consists of steep to very steep escarpments and escarpment-like landscapes. The terrace escarpments occur on the nearly even fronts of terraces or alluvial fans. The escarpment-like landscapes occur between narrow flood plains and adjoining uplands and the very steep sides of drainageways that are entrenching into fairly level uplands. In most places there is 4 to 10 inches of loamy or gravelly soil over soft marine sandstone, shale, or gravelly sediments. The vegetation ranges from a sparse cover of brush and annual forbs and grasses on south-facing slopes, to a fairly dense cover on north-facing slopes.

This land type occurs mainly on the coastal plain and as small areas in the foothills and the desert. It is used chiefly for watershed. Capability unit VIIIE-1 (19, 20, 30).

Tidal Flats

Tidal flats (Tf) occurs as level areas that are periodically covered with tidal water. They are essentially barren. The higher parts that are seldom covered during high tide support a sparse salt-tolerant vegetation. The texture ranges from clay to very fine sand. Typically, the material has an excess of soluble salts.

This land type is used for wildlife habitat. Capability unit VIIIW-6 (19).

Tollhouse Series

The Tollhouse series consists of excessively drained, shallow to very shallow coarse sandy loams that formed in material weathered from granodiorite. These soils are in the mountains and have slopes of 5 to 65 percent. The elevation ranges from 3,000 to 5,000 feet. The mean annual precipitation is between 15 and 20 inches, and the mean annual air temperature between 56° and 58° F. The frost-free season is 140 to 175 days. The vegetation is chiefly scrub oak, chamise, ceanothus, elm brush, and annual grasses.

In a representative profile, the surface layer is dark grayish-brown, neutral and slightly acid coarse sandy loam about 12 inches thick. The next layer is pale-brown, slightly acid coarse sandy loam. At a depth of about 16 inches is pale-brown, hard granodiorite. About 10 percent of the area is covered with rock outcrop.

Tollhouse soils are used for wildlife habitat, recreational areas, watershed, and range.

Tollhouse rocky coarse sandy loam, 5 to 30 percent slopes, eroded (ToE2).--This gently sloping to moderately steep soil is on uplands. Slopes are dominantly 25 percent. About 10 percent of the surface is covered with rock outcrops, and 20 percent with boulders.

Representative profile: 200 feet north of Highway 80, 1 mile west of the Crestwood Motel in the northeast quarter of sec. 15, T. 17 S., R. 6 E.

- A11--0 to 4 inches, dark grayish-brown (10YR 4/2) coarse sandy loam, very dark grayish brown (10YR 3/2) moist; moderate, fine and medium, granular structure; soft, very friable, non-sticky, nonplastic; common very fine and fine roots; many fine interstitial pores; neutral (pH 6.7); clear, smooth boundary.
- A12--4 to 12 inches, dark grayish-brown (10YR 4/2) coarse sandy loam, very dark grayish brown (10YR 3/2) moist; weak, fine and medium, granular structure; soft, very friable, nonsticky, nonplastic; few very fine and fine roots; many fine interstitial pores; slightly acid (pH 6.5); abrupt, irregular boundary.
- AC--12 to 16 inches, pale-brown (10YR 6/3) coarse sandy loam, brown (10YR 4/3) moist; massive; slightly hard, friable, nonsticky, nonplastic; very few fine roots; common fine interstitial pores; slightly acid (pH 6.5); clear, intermittent boundary.
- R--16 inches, mainly hard, undecomposed granodiorite; weathered in a few places.

The A horizon ranges from dark grayish brown to grayish brown in color, from coarse sandy loam to loamy coarse sand in texture, and from 6 to 15 inches in thickness. The AC horizon ranges from pale brown to brown in color, from coarse sandy loam to loamy coarse sand in texture, and from 1 to 5 inches in thickness. Sheet and rill erosion have been moderate.

Included with this soil in mapping are small areas of La Posta soils, Kitchen Creek soils, and Mottsville soils.

Fertility is low. Permeability is rapid. The available water holding capacity is 1 to 2 inches. Runoff is medium to rapid, and the erosion hazard moderate to high. The rooting depth is 7 to 20 inches.

This soil is used for recreational areas, wildlife habitat, watershed, and limited range. Capability unit VIIe-7 (20); Shallow Loamy range site.

Tollhouse rocky coarse sandy loam, 30 to 65 percent slopes (ToG).--This soil is steep to very steep and is only 5 to 20 inches deep over hard rock. It is slightly eroded. Large boulders cover 20 to 25 percent of the area, and rock outcrops 10 percent. Runoff is rapid to very rapid, and the erosion hazard high to very high. In other features, this soil is similar to Tollhouse rocky coarse sandy loam, 5 to 30 percent slopes.

Included in mapping are small areas of La Posta soils, Kitchen Creek soils, and Mottsville soils.

This Tollhouse soil is used for watershed, wildlife habitat, and limited range. Capability unit VIIe-7 (20); Shallow Loamy range site.

Tujunga Series

The Tujunga series consists of very deep, excessively drained sands derived from granitic alluvium. These soils are on alluvial fans and flood plains and have slopes of 0 to 5 percent. The elevation ranges from sea level to 1,500 feet. The mean annual precipitation is between 10 and 18 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 240 to 320 days. The winter growing season has only light frost. The vegetation in uncultivated areas is chiefly annual grasses and forbs and a few scattered oaks.

In a representative profile, the surface layer is brown, neutral sand about 14 inches thick. The next layers are pale-brown, neutral sand and coarse sand. This material extends to a depth of more than 60 inches.

Tujunga soils are used mainly for range and golf courses. A few small areas are used for avocados, flowers, and truck crops.

Tujunga sand, 0 to 5 percent slopes (TuB).--This soil is on alluvial fans and flood plains. Slopes are dominantly 2 percent.

Representative profile: 35 feet south of San Luis Rey River channel on farm road that crosses flood plain, SE 1/4 of NW 1/4 of NW 1/4 sec. 18, T. 11 S., R. 4 W.

- C1--0 to 14 inches, brown (10YR 5/3) sand, dark grayish brown (10YR 4/2) moist; single grain; loose, nonsticky, nonplastic; many very fine and fine roots; many interstitial pores; neutral (pH 6.7); gradual, wavy boundary.
- C2--14 to 34 inches, pale-brown (10YR 6/3) sand, brown (10YR 5/3) moist; single grain; loose, nonsticky, nonplastic; common very fine and fine roots; many interstitial pores; neutral (pH 6.9); gradual, wavy boundary.
- C3--34 to 60 inches, pale-brown (10YR 6/3) coarse sand; brown (10YR 5/3) moist; single grain; loose, nonsticky, nonplastic; few very fine roots; neutral (pH 7.0).

The C1 horizon ranges from brown to pale brown and very pale brown in color, from coarse sand to loamy fine sand in texture, and from 8 to 16 inches in thickness. The C2 and C3 horizons can extend to a depth of more than 60 inches. They range from pale brown to very pale brown in color and from coarse sand to loamy fine sand in texture. They are stratified with gravelly sand.

Included with this soil in mapping are small areas of Grangeville soils, Ramona soils, Visalia soils, and Riverwash. Also included in the area of the upper San Luis Rey River are small areas that have a surface layer of sandy loam.

Fertility is low. Permeability is very rapid. The available water holding capacity is 3 to 4 inches. Runoff is very slow to slow, and the erosion hazard is slight. Roots easily penetrate to a depth

of 60 inches. Short periods of flooding are probable.

This soil is used mainly for range and golf courses. A few small areas are used for avocados, flowers, and truck crops. Capability unit IVs-4 (19); Sandy range site.

Urban Land

Urban land (Ur) consists of closely built-up areas in cities. Buildings, streets, and sidewalks cover almost all of the surface. The soil has been so altered by urban works that identification is not feasible.

Visalia Series

The Visalia series consists of moderately well drained, very deep sandy loams derived from granitic alluvium. These soils are on alluvial fans and flood plains and have slopes of 0 to 15 percent. The elevation ranges from 400 to 2,000 feet. The mean annual precipitation is between 14 and 18 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 260 to 320 days. Areas close to the coast have only light frost. The vegetation is chiefly annual grasses, chamise, flat-top buckwheat, California live oak, and scrub oak.

In a representative profile, the surface layer is dark grayish-brown, slightly acid sandy loam about 12 inches thick. The next layers are dark grayish-brown, slightly acid sandy loam and loam. This material extends to a depth of more than 60 inches. In some areas the soil is gravelly throughout.

Visalia soils are used for avocados, citrus, walnut orchards, truck crops, irrigated pasture, field crops, tomatoes, flowers, and nursery stock.

Visalia sandy loam, 0 to 2 percent slopes (VaA).--This nearly level to level soil is on flood plains. Slopes are dominantly 2 percent.

Representative profile: Approximately 80 feet south of the Rincon Road, NW 1/4 of NW 1/4 of NW 1/4 sec. 16, T. 11 S., R. 1 W.

Ap--0 to 12 inches, dark grayish-brown (10YR 4/2) sandy loam, very dark brown (10YR 2/2) moist; weak, fine, granular structure; soft, very friable, nonsticky, nonplastic; common very fine roots; many fine interstitial pores; slightly acid (pH 6.5); gradual, smooth boundary.

C1--12 to 40 inches, dark grayish-brown (10YR 4/2) sandy loam, dark brown (10YR 3/3) moist; massive; slightly hard, friable, slightly sticky, slightly plastic; common very fine roots; common fine tubular pores; slightly acid (pH 6.3); gradual, smooth boundary.

C2--40 to 60 inches, dark grayish-brown (10YR 4/2) loam, dark brown (10YR 3/3) moist; massive; slightly hard, friable, slightly sticky; slightly plastic; common fine tubular pores; slightly acid (pH 6.3).

The Ap horizon ranges from dark brown or brown to dark grayish brown in color, from sandy loam to fine sandy loam in texture, and from 8 to 14 inches in thickness. The C1 and C2 horizons range from brown to dark grayish brown in color and from loam to sandy loam in texture. Thin strata of loamy sand and sand are common. In places the profile is calcareous in the C2 horizon, below a depth of 40 inches.

Included with this soil in mapping are small areas of Greenfield soils, Grangeville soils, Placencia soils, and Tujunga soils.

Fertility is high. Permeability is moderately rapid. The available water holding capacity is 8 to 9.5 inches. Runoff is very slow, and the erosion hazard is slight. The rooting depth is 60 inches or more. Flooding may occur for short periods.

This soil is used for tomatoes, truck crops, avocados, citrus, flowers, small grain, and nursery stock. Capability unit I-1 (19).

Visalia sandy loam, 2 to 5 percent slopes (VaB).--This soil is gently sloping. Runoff is slow, and the erosion hazard is slight. In other features, this soil is similar to Visalia sandy loam, 0 to 2 percent slopes.

Included in mapping are small areas of Greenfield soils, Grangeville soils, Placencia soils, and Tujunga soils.

This Visalia soil is used for avocados, citrus, truck crops, tomatoes, flowers, walnuts, pasture, and nursery stock. Capability unit IIe-1 (19).

Visalia sandy loam, 5 to 9 percent slopes (VaC).--This soil is moderately sloping. Runoff is slow to medium, and the erosion hazard slight to moderate. In other features, this soil is similar to Visalia sandy loam, 0 to 2 percent slopes.

Included in mapping are small areas of Greenfield soils, Placencia soils, Ramona soils, and Tujunga soils.

This Visalia soil is used for avocados, citrus, tomatoes, truck crops, flowers, walnut, nursery stock, and range. Capability unit IIe-1 (19); Loamy range site.

Visalia sandy loam, 9 to 15 percent slopes (VaD).--This strongly sloping soil generally occurs at the base of steep slopes. In many areas it formed in colluvium of sandy loam texture. Runoff is medium, and the erosion hazard is moderate. In other features, this soil is similar to Visalia sandy loam, 0 to 2 percent slopes.

Included in mapping are small areas of Greenfield soils, Placencia soils, Ramona soils, and Vista soils.

This Visalia soil is used for avocados, citrus, tomatoes, flowers, walnuts, and range. Capability unit IIIe-1 (19); Loamy range site.

Visalia gravelly sandy loam, 2 to 5 percent slopes (VbB).--This soil is gently sloping and is about 15 percent gravel. The available water holding capacity is 6 to 8 inches. Runoff is slow, and the

erosion hazard slight. In other features, this soil is similar to Visalia sandy loam, 0 to 2 percent slopes.

Included in mapping are small areas of Greenfield soils, Placentia soils, and Tujunga soils.

This Visalia soil is used for avocados, citrus, truck crops, tomatoes, flowers, and range. Capability unit IIe-1 (19); Loamy range site.

Visalia gravelly sandy loam, 5 to 9 percent slopes (VbC).--This soil is moderately sloping and is about 15 percent gravel. The available water holding capacity is 6 to 8 inches. Runoff is slow to medium, and the erosion hazard slight to moderate. In other features, this soil is similar to Visalia sandy loam, 0 to 2 percent slopes.

Included in mapping are small areas of Greenfield soils, Placentia soils, Ramona soils, and Tujunga soils.

This Visalia soil is used for avocados, citrus, tomatoes, truck crops, flowers, walnuts, and range. Capability unit IIe-1 (19); Loamy range site.

Vista Series

The Vista series consists of well-drained, moderately deep and deep coarse sandy loams derived from granodiorite or quartz diorite. These soils are on uplands and have slopes of 5 to 65 percent. The elevation ranges from 300 to 2,500 feet. The mean annual precipitation is between 14 and 18 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 260 to 320 days. The winter growing season has only light frost. The vegetation in uncultivated areas consists of chamise, flattop buckwheat, mustard, sumac, sugarbush, soft chess, ripgut brome, wild oats, foxtail, and annual forbs. There are scattered oaks on the north slopes and along drainageways.

In a representative profile, the surface layer is dark grayish-brown and dark-brown, neutral and slightly acid sandy loam about 19 inches thick. The subsoil is dark-brown and yellowish-brown, slightly acid coarse sandy loam about 16 inches thick. Below this is strongly weathered granitic rock (pl. V).

Vista soils are used chiefly for avocados and citrus orchards, truck crops, flowers, small grain, range, and housing developments.

Vista coarse sandy loam, 9 to 15 percent slopes (VsD).--This moderately steep soil is on uplands. The slope averages 10 percent.

Representative profile: About 2 1/2 miles south and 1/4 mile east of Fallbrook, NE 1/4 of SW 1/4 sec. 31, T. 9 S., R. 3 W. (projected), approximately 440 feet north-northwest of southeast corner of campus of Fallbrook Union High School,

A11--0 to 3 inches, dark grayish-brown (10YR 4/2) coarse sandy loam, dark brown (10YR 3/3) moist; moderate, fine and medium, crumb structure; soft, very friable, nonsticky, nonplastic; common very fine and fine roots; many

very fine and fine interstitial pores; neutral (pH 6.7); abrupt, smooth boundary.

A12--3 to 9 inches, dark-brown (10YR 4/3) coarse sandy loam, dark brown (10YR 3/3) moist; weak, fine and medium, granular structure; slightly hard, very friable, nonsticky, nonplastic; common very fine and fine roots; common very fine and fine tubular pores; neutral (pH 6.7); clear, irregular boundary. Krotovinas filled with material resembling this horizon, 3 to 4 inches wide, extend into the underlying horizons, in places into the upper part of the weathered quartz diorite bedrock.

A13--9 to 19 inches, dark-brown (10YR 4/3) coarse sandy loam, dark brown (10YR 3/3) moist; weak, fine and medium, granular structure; slightly hard, very friable, nonsticky, nonplastic; few, very fine and fine roots; common very fine and fine tubular pores; slightly acid (pH 6.5); numerous krotovinas and animal burrows; clear, wavy boundary.

B21--19 to 28 inches, dark-brown (10YR 4/3) sandy loam, dark brown (10YR 3/3) moist; massive; hard, friable, nonsticky, nonplastic; few very fine roots; common very fine and fine tubular pores; slightly acid (pH 6.3); numerous krotovinas and animal burrows; clear, smooth boundary.

B22--28 to 35 inches, yellowish-brown (10YR 5/4) sandy loam, dark yellowish brown (10YR 3/4) moist; massive; hard, friable, nonsticky, nonplastic; very few very fine and fine roots; common very fine and fine tubular pores; slightly acid (pH 6.3); numerous krotovinas and animal burrows; abrupt, irregular boundary.

C--35 inches, yellowish-brown (10YR 5/4) and very pale brown (10YR 7/4), weathered quartz diorite and gruss, mostly plagioclase feldspar, biotite, hornblende, and quartz; irregular boundary.

The A horizon ranges from dark grayish brown or grayish brown to brown or dark brown in color, from coarse sandy loam to sandy loam in texture, and from 14 to 23 inches in thickness. The B horizon ranges from dark brown to brown or yellowish brown in color, from coarse sandy loam to sandy loam in texture, and from 13 to 24 inches in thickness. The depth to weathered granitic rock ranges from 27 to 47 inches.

Included with this soil in mapping are small areas of Fallbrook soils, Cieneba soils, Bonsall soils, and Greenfield soils.

Fertility is medium. Permeability is moderately rapid. The available water holding capacity is 4 to 6 inches. Runoff is medium, and the erosion hazard moderate. The rooting depth is 27 to 47 inches.

This soil is used mainly for avocado and citrus orchards, tomatoes, flowers, small grain, and range. Some areas are used for housing developments. Capability unit IVe-1 (19); Loamy range site.

Vista coarse sandy loam, 5 to 9 percent slopes (VsC).--This soil is moderately sloping. Runoff is slow to medium, and the erosion hazard slight to moderate. In other features, this soil is similar to Vista coarse sandy loam, 9 to 15 percent slopes.

Included in mapping are small areas of Fallbrook soils, Bonsall soils, Greenfield soils, and Ramona soils.

This Vista soil is used mainly for avocados, citrus, tomatoes, truck crops, flowers, and range. Some areas are used for housing developments. Capability unit IIIe-1 (19); Loamy range site.

Vista coarse sandy loam, 9 to 15 percent slopes, eroded (VsD2).--This soil is strongly sloping and is 20 to 42 inches deep over weathered rock. Rill and gully erosion have been moderate. The available water holding capacity is 3.5 to 5.5 inches. Runoff is medium, and the erosion hazard moderate. In other features, this soil is similar to Vista coarse sandy loam, 9 to 15 percent slopes.

Included in mapping are small areas of Fallbrook soils, Cienega soils, Bonsall soils, and Greenfield soils.

This Vista soil is used mainly for avocados, citrus, tomatoes, flowers, small grain, and range. Some areas are used for housing developments. Capability unit IVe-1 (19); Loamy range site.

Vista coarse sandy loam, 15 to 30 percent slopes (VsE).--This soil is moderately steep and is 20 to 42 inches deep over weathered rock. The available water holding capacity is 3.5 to 5.5 inches. Runoff is medium to rapid, and the erosion hazard moderate to high. In other features, this soil is similar to Vista coarse sandy loam, 9 to 15 percent slopes.

Included in mapping are small areas of Fallbrook soils and Cienega soils.

This Vista soil is used for avocados, citrus, and range. Capability unit VIe-1 (19); Loamy range site.

Vista coarse sandy loam, 15 to 30 percent slopes, eroded (VsE2).--This soil is moderately steep and is 20 to 40 inches deep over weathered rock. Gully and rill erosion have been moderate. The available water holding capacity is 3.5 to 5 inches. Runoff is medium to rapid, and the erosion hazard moderate to high. In other features, this soil is similar to Vista coarse sandy loam, 9 to 15 percent slopes.

Included in mapping are small areas of Fallbrook soils and Cienega soils.

This Vista soil is used for avocados, citrus, and range. Capability unit VIe-1 (19); Loamy range site.

Vista coarse sandy loam, 30 to 65 percent slopes (VsG).--This soil is steep to very steep and is 20 to 40 inches deep over weathered rock. The available water holding capacity is 3.5 to 5 inches. Runoff is rapid to very rapid, and the erosion hazard high to very high. In other features, this soil is similar to Vista coarse sandy loam, 9 to 15 percent slopes.

Included in mapping are small areas of Cienega soils.

This Vista soil is used for avocados (pl. V) and range. Capability unit VIIe-1 (19); Loamy range site.

Vista rocky coarse sandy loam, 5 to 15 percent slopes (VvD).--This soil is moderately sloping to strongly sloping and is 20 to 36 inches deep over weathered rock. About 10 percent of the area is covered with exposed bedrock, and about 10 percent with large boulders. The available water holding capacity is 2 to 4.5 inches. Runoff is slow to medium, and the erosion hazard slight to moderate. In other features, this soil is similar to Vista coarse sandy loam, 9 to 15 percent slopes.

Included in mapping are small areas of Fallbrook soils and Cienega soils.

This Vista soil is used for avocados, citrus, and range. Capability unit VIe-7 (19); Loamy range site.

Vista rocky coarse sandy loam, 15 to 30 percent slopes (VvE).--This soil is moderately steep and is 20 to 34 inches deep over weathered rock. About 10 percent of the area is covered with rock outcrops, and 10 percent with large boulders. The available water holding capacity is 2 to 4.5 inches. Runoff is medium to rapid, and the erosion hazard moderate to high. In other features, this soil is similar to Vista coarse sandy loam, 9 to 15 percent slopes.

Included in mapping are small areas of Fallbrook soils and Cienega soils.

This Vista soil is used mainly for range. Avocados and citrus are grown in areas where rock outcrops and boulders are not too numerous. Capability unit VIe-7 (19); Loamy range site.

Vista rocky coarse sandy loam, 30 to 65 percent slopes (VvG).--This soil is steep to very steep and is 20 to 32 inches deep over weathered rock. About 10 percent of the area is covered with rock outcrops, and about 10 to 20 percent with large boulders. The available water holding capacity is 2 to 4 inches. Runoff is rapid to very rapid, and the erosion hazard high to very high. In other features, this soil is similar to Vista coarse sandy loam, 9 to 15 percent slopes.

Included in mapping are small areas of Cienega rocky coarse sandy loam.

This Vista soil is used mainly for watershed, wildlife habitat, and range. Avocados are grown in areas where rock outcrops and boulders are not too numerous. Capability unit VIIe-7 (19); Loamy range site.

Wyman Series

The Wyman series consists of well-drained, very deep loams that formed in alluvium derived from basic igneous rock. These soils are on alluvial fans and have slopes of 2 to 15 percent. The elevation ranges from 400 to 2,200 feet. The mean annual precipitation is between 14 and 18 inches, and the mean annual air temperature between 60° and 62° F. The frost-free season is 250 to 300 days. The winter growing season has only light frost. The

vegetation is chiefly flattop buckwheat, wild oats, and annual grasses and forbs.

In a typical profile, the surface layer is brown and reddish-brown, slightly acid and neutral loam about 13 inches thick. The subsoil is reddish-brown and brown, neutral clay loam about 27 inches thick. The substratum is brown, neutral, heavy loam and fine sandy loam. It extends to a depth of more than 60 inches.

Wyman soils are used for citrus orchards, truck crops, tomatoes, flowers, and range.

Wyman loam, 2 to 5 percent slopes (WmB).--This gently sloping soil is on alluvial fans. The slope averages 4 percent.

Representative profile: 200 feet west of the east quarter corner of sec. 23, T. 18 S., R. 3 W.

- A1--0 to 7 inches, brown (7.5YR 5/2) loam, dark brown (7.5YR 3/2) moist; moderate, fine and medium, granular structure; soft, friable, slightly sticky, slightly plastic; few medium roots, common very fine and fine roots; many very fine interstitial pores; slightly acid (pH 6.3); abrupt, smooth boundary.
- A3--7 to 13 inches, reddish-brown (5YR 5/3) loam, dark reddish brown (5YR 3/3) moist; massive; hard, friable, slightly sticky, slightly plastic; few fine and medium roots, common very fine roots; few fine and medium tubular pores; neutral (pH 6.7); gradual, smooth boundary.
- B21t--13 to 18 inches, reddish-brown (5YR 5/3) clay loam, dark reddish brown (5YR 3/3) moist; weak, medium and coarse, angular blocky structure; very hard, friable, slightly sticky, slightly plastic; few fine and medium roots; very few fine and medium tubular pores; common thin clay films on ped faces and as bridges; neutral (pH 7.0); gradual, smooth boundary.
- B22t--18 to 29 inches, brown (7.5YR 7/4) clay loam, dark brown (7.5YR 4/4) moist; weak, medium and coarse, angular blocky structure; very hard, friable, sticky, plastic; few fine and medium roots; very few fine and medium tubular pores; common thin clay films as bridges and on ped faces; neutral (pH 7.0); gradual, smooth boundary.
- B23t--29 to 40 inches, brown (7.5YR 5/2) clay loam, dark brown (7.5YR 4/2) moist; weak, medium and coarse, angular blocky structure; very hard, friable, sticky, plastic; few very fine and fine roots; very few fine tubular pores;

few thin clay films on ped faces and as bridges; neutral (pH 7.0); gradual, smooth boundary.

C1--40 to 67 inches, brown (7.5YR 5/4) heavy loam, dark brown (7.5YR 4/2) moist; massive; very hard, friable, slightly sticky, slightly plastic; few very fine roots; few thin clay films as bridges; neutral (pH 7.2); gradual, smooth boundary.

C2--67 to 72 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; massive; hard, friable; neutral (pH 7.2).

The A horizon ranges from brown or reddish brown to strong brown in color, from loam to fine sandy loam in texture, and from 9 to 19 inches in thickness. The B horizon ranges from reddish brown to brown or dark brown in color, from clay loam to heavy loam in texture, and from 20 to 40 inches in thickness. The depth to the C horizon ranges from 29 to 59 inches.

Included with this soil in mapping are small areas of Las Posas soils, Placentia soils, Ramona soils, and Visalia soils.

Fertility is high. Permeability is moderately slow. The available water holding capacity is 9 to 11 inches. Runoff is slow, and the erosion hazard slight. The rooting depth is more than 60 inches.

This soil is used for citrus orchards, truck crops, tomatoes, flowers, and range. Capability unit IIe-1 (19); Loamy range site.

Wyman loam, 5 to 9 percent slopes (WmC).--This soil is moderately sloping. Runoff is slow to medium, and the erosion hazard slight to moderate. In other features, this soil is similar to Wyman loam, 2 to 5 percent slopes.

Included in mapping are small areas of Las Posas soils, Placentia soils, Ramona soils, and Visalia soils.

This Wyman soil is used for citrus, truck crops, tomatoes, flowers, and range. Capability unit IIe-1 (19); Loamy range site.

Wyman loam, 9 to 15 percent slopes (WmD).--This soil is strongly sloping. Runoff is medium, and the erosion hazard is moderate. In other features, this soil is similar to Wyman loam, 2 to 5 percent slopes.

Included in mapping are small areas of Las Posas soils, Ramona soils, and Placentia soils.

This Wyman soil is used for citrus, tomatoes, flowers, and range. Capability unit IIe-1 (19); Loamy range site.

FORMATION, MORPHOLOGY, AND CLASSIFICATION OF THE SOILS

This section describes the factors that have affected the formation and composition of the soils in the San Diego Area. It also presents the morphological characteristics of the soils and classifies them into higher categories according to the system of classification now in use in the United States (12)

Soils differ in their appearance, composition, management requirements, and productivity in different localities, or even within short distances. These differences are the result of the interaction of five soil-forming factors, namely, parent material, relief, climate, living organisms, and time.

The relative effect of each of these factors varies within each soil.

Formation of the Soils

The parent material from which the soils in the survey area developed is complex and variable.

The relief differs among the four physiographic provinces--the Coastal Plains, the Foothills, the Mountains, and the Desert.

The climate varies within the Area. The Coastal Plains has an equable climate, but the Mountains and the Desert have wide ranges in temperature. Accordingly, many different kinds of plants grow in these areas.

The age of the soils also varies. The age of the soil is not related directly to the geologic age of the parent rock; some soils are of recent origin, even though the parent rock geologically is very old. Most of the formations in this Area range in geologic time from Cretaceous to Quaternary.

Coastal Plains

The Coastal Plains is an area of rolling to steep topography (fig. 5). The elevation ranges from sea level to about 600 feet. Part of this coastal area is a series of fairly smooth terraces locally known as mesas, some of which are level and some dissected. The unequal altitudes of terraces of the same age indicate uplift of the coastal area as the major cause in forming the terraces. The lowest wavecut terraces have distinct cliffs or escarpments along the seaward edge. The elevation of the marine

terraces ranges from nearly sea level to about 800 feet.

The Coastal Plains has the most equable climate of any area in the county. Temperature and precipitation vary according to the elevation and the distance from the seacoast. Generally, the temperature decreases and the precipitation increases with increasing elevation. The mean annual temperature is 61° F., and the mean minimum temperature in January is 42°. The frost-free season is 280 to 360 days. The winter growing season has only light frost. Annual rainfall ranges from 10 to 16 inches; 90 percent of this amount falls during the period November to April. Most soils are thoroughly moistened during this period, but little leaching occurs. Fog along the coast contributes humidity to the atmosphere and thus reduces loss of moisture by transpiration. Soil moisture, however, is used up during rapid plant growth in spring. Unless irrigated, the soils are dry by summer. Organic matter is oxidized during the long, warm summer and fall, so the soils are fairly low in organic-carbon content.

The Miramar Mesa is made up of poorly sorted gravelly and cobbly alluvium of Eocene Age. Redding and Olivenhain soils developed in this material. Redding soils have a gravelly clay subsoil that is underlain by an iron-silica hardpan. Olivenhain soils have a very cobbly clay loam subsoil but do not have a hardpan.

Semiconsolidated sandstone, shale, and unconsolidated sediments occur in the area between the beach ridges and the Foothills. These sediments weather readily if they are interbedded with shale, because calcium carbonate is the principal cementing agent. The soils in this area are moderately coarse textured to fine textured and have a calcareous subsoil.

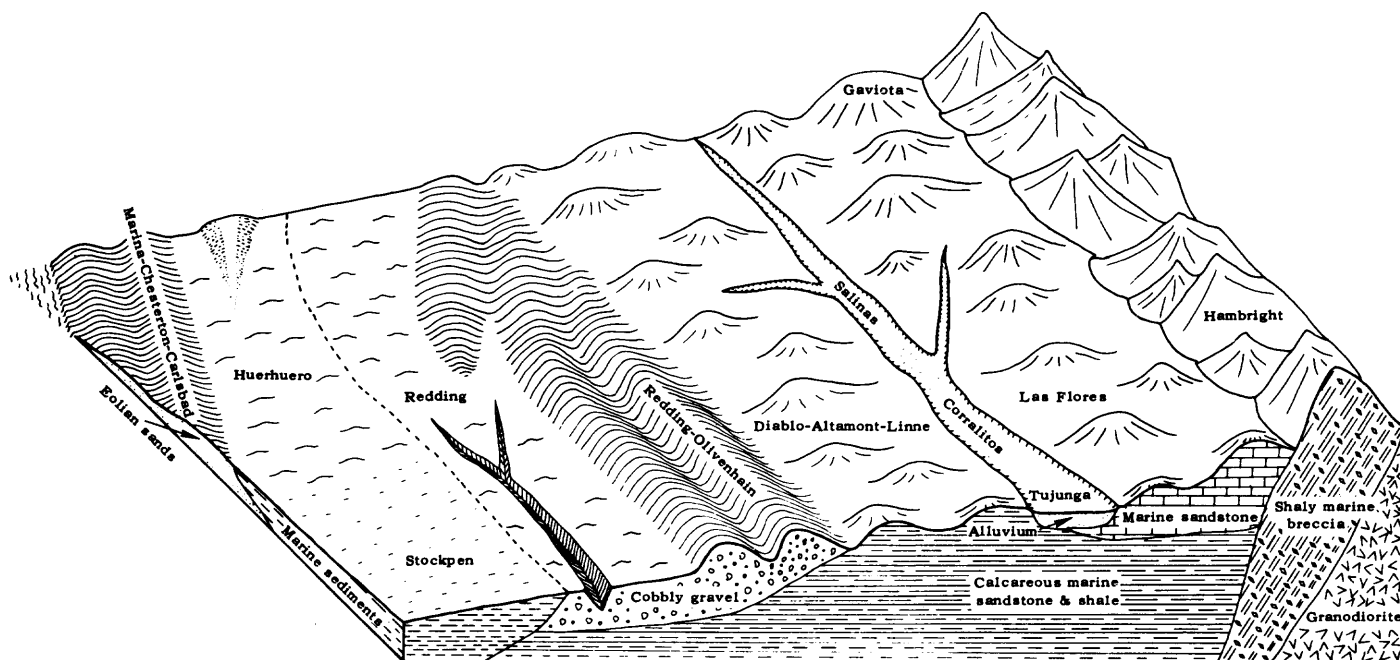


Figure 5.--Typical pattern of soils and underlying material of the Coastal Plains.

Diablo, Linne, and Altamont soils are fine textured to moderately fine textured. Huerhuero, Las Flores, and Stockpen soils have an argillic horizon. Gaviota soils are moderately coarse textured and are underlain by semiconsolidated marine sandstone.

Corralitos, Elder, and Tujunga soils developed in recent sandy alluvium. This material consists of relatively unweathered sediments on flood plains and alluvial fans. It occurs mainly on the Coastal Plains.

Salinas soils developed in clayey alluvium derived mainly from Diablo, Linne, Olivenhain, and Huerhuero soils. This alluvium is clay loam to clay in texture. It occurs in narrow drainageways and on alluvial fans on the Coastal Plains.

The San Onofre breccia on the Coastal Plains is probably of Miocene age. Most likely it came about during uplift of the coastal area, or fluctuations in sea level, or both. Hambright soils were derived from this material.

The vegetation consists of annual grasses, forbs, and brush. Chamise, scrub oak, and sumac are prominent brush species. Wild oats, cheatgrass, and flattop buckwheat are other common plants. There are also scattered oaks and many introduced eucalyptus trees.

Moisture is the main limiting factor. Plant growth is rapid in spring until about June, when the moisture supply is depleted. When the soil is moist, micro-organisms are active and organic matter is oxidized at about the same rate it is added to the soil. The organic-carbon content is about 0.7 percent in the surface layer. It decreases with increasing depth. On shallow, droughty soils there is not enough plant growth to control erosion.

Foothills

The Foothills is a belt of narrow winding valleys and rolling to hilly uplands that have few very steep slopes (fig. 6). This belt lies between the Coastal Plains and the Mountains. It is about 28 miles wide and extends in a northwest-southeast direction from Orange and Riverside Counties to the Mexican border. The elevation ranges from about 600 to 2,000 feet. The Foothills and the Coastal Plains are transversed by the Santa Margarita, San Luis Rey, San Dieguito, San Diego, Sweetwater, and Otay Rivers and by numerous small creeks. All of these streams flow for only a short period after a heavy rainstorm. The adjacent small to large valleys are important farming areas.

The climate in the Foothills is similar to that of the Coastal Plains. The mean annual temperature is 60° F., and the mean minimum temperature in January is 38°. The frost-free season is 220 to 340 days. The winter growing season has only light frost. The amount of rainfall increases with increasing elevation. The total annual rainfall ranges from 12 to 20 inches. Rainfall is heaviest during the period December to April. Most soils are thoroughly moistened during this period, but little leaching occurs. The growing season is short because rapid plant growth in spring uses up soil moisture. Organic matter is oxidized during the long, dry summer; thus, the soils are low in organic-carbon content.

The parent rocks range from granite to gabbro. Most are tonalite and granodiorite and occur as fractured blocks 2 to 10 feet across. The fractures weather out and leave the rest of the block a

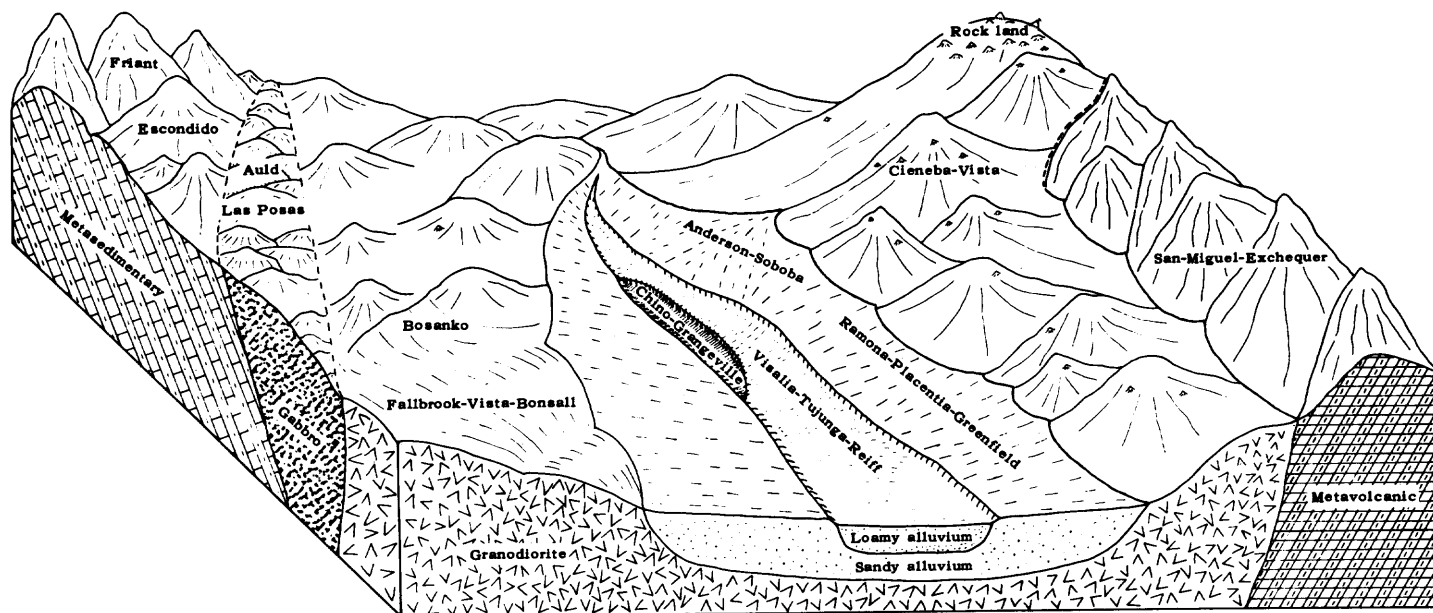


Figure 6.--Typical pattern of soils and underlying material of the Foothills.

disintegrated boulder (2). Associated with this bouldery topography are the rocky Cieneba, Fallbrook, and Vista soils. All have large boulders on the surface and within the gruss, which is weathered to a considerable depth.

Parent material weathered from decomposed granite is dominant in the Foothills, the Mountains, and the Desert. This material is soft and is easily eroded. It contains sand fragments, mainly quartz, that act as an abrasive when carried by runoff. The soils derived from decomposed granite are shallow to deep and are mostly sandy loams. The topography is hilly. Hilltops are rounded or slightly convex, slopes are moderate to very steep, and foot slopes are somewhat concave. Cultivated areas are subject to gully and sheet erosion. The Bonsall, Bosanko, Cieneba, Fallbrook, and Vista soils in the Foothills were derived from decomposed granite.

Gabbro, or basic intrusive rock, occurs as islands in the Foothills and in the Mountains. It has weathered to a considerable depth. The soils that developed in this material have a surface layer of fine sandy loam or loam, are shallow to moderately deep, and contain angular, stone size fragments. There are no boulders in these areas, in contrast with the very large, light-colored boulders strewn about in areas underlain by granite. The topography is hilly. Some slopes are steep and have concave foot slopes. Cultivated areas are subject to sheet and gully erosion. The Las Posas and Blasingame soils in the Foothills were derived from gabbro.

Metasedimentary and metavolcanic rocks, which occur mainly in the Foothills, are hard and unweathered. The soils derived from these rocks are moderately deep to very shallow and contain numerous rock

fragments. Auld and San Miguel soils were derived from metavolcanic rock and contain montmorillinitic clay. Escondido, Exchequer, and Friant soils were derived from metasedimentary rock and are fine sandy loam to silt loam in texture. Exchequer and Friant soils lose soil material through erosion almost as fast as it forms.

The young granitic alluvium in the Foothills was derived predominantly from granitic rock. It is very gravelly sandy loam to fine sandy loam in texture and is fairly well sorted. It occurs in broad basins, on alluvial fans, and in narrow drainage ways. The Anderson, Chino, Grangeville, Reiff, and Visalia soils in the Foothills developed in this material.

The old granitic alluvium that has formed in valleys and on terraces and alluvial fans in the Foothills is mainly granitic in origin but has small inclusions of medium-textured sediments of Pleistocene age. Arlington, Greenfield, Placentia, Ramona, and Wyman soils in the Foothills developed in this alluvium. Except for Arlington and Greenfield soils, all have a strongly developed clayey subsoil.

Mountains

Between the Foothills and the Desert are steep-walled, bouldery peaks and broad-based, cone-shaped mountains (fig. 7). The topography is rugged. The elevation ranges mainly from 2,000 to 6,000 feet; some peaks rise above 6,000 feet. The mountain range has a northwest-southeast trend but is broken by faults and by river valleys. The steep topography, the rockiness, and the shallow soils make

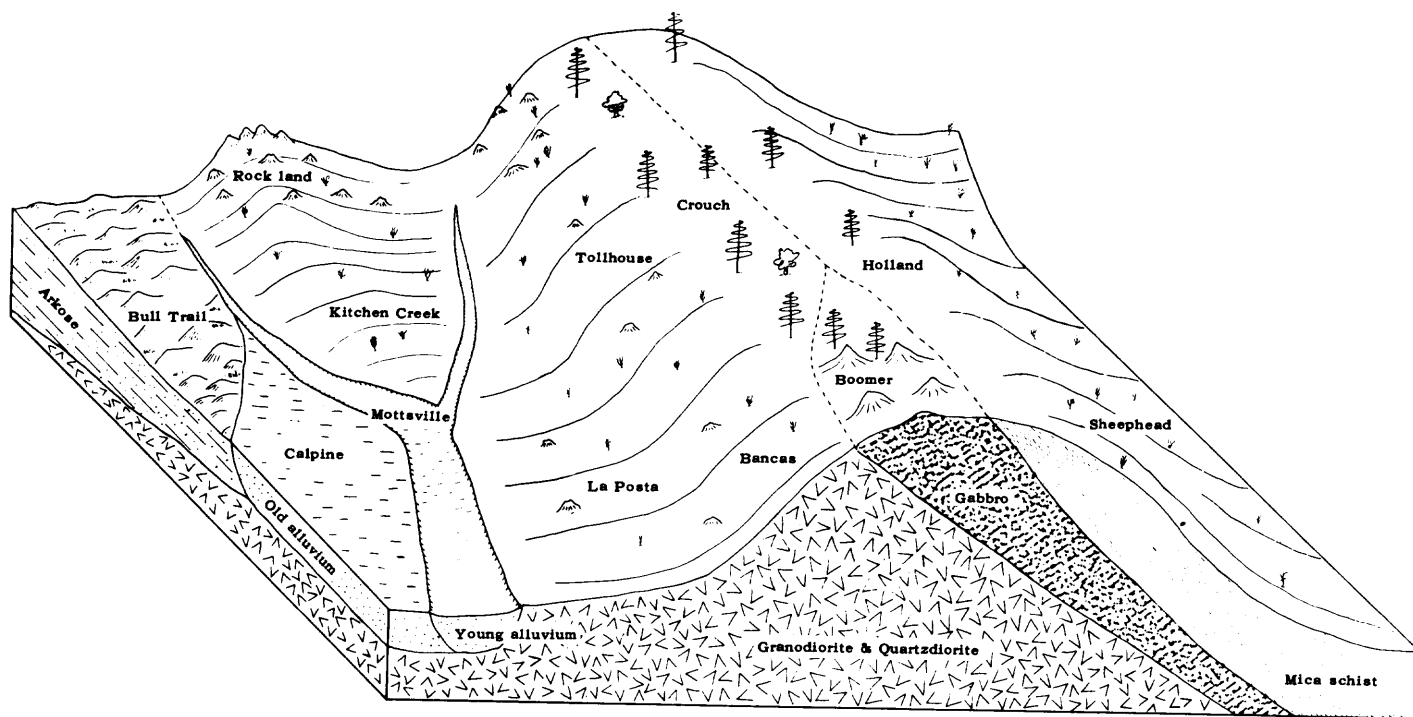


Figure 7.--Typical pattern of soils and underlying material of the Mountains.

the greater part of this area unusable for cultivated crops.

The Mountain area is the coolest, wettest part of the San Diego Area. It receives 12 to 40 inches of precipitation, mainly in winter. The mean annual temperature is 55° F., and the mean minimum temperature in January is 32°. The frost-free season is 150 to 200 days. Snow stays on the ground for only short periods. The soils rarely, if ever, freeze.

Vegetation is more abundant in the Mountains than in other parts of the Area. It consists of digger pine, Jeffery pine, white fir, black oak, interior live oak, and incense-cedar. There are also areas of grass and brush. Soils under the pine and oak trees have mats 1 inch to 5 inches thick of fresh and somewhat decomposed needles, leaves, and twigs. The cool climate slows the rate at which microorganisms reduce the supply of organic matter, so these soils typically have the highest organic-carbon content of any soils in the survey area. The organic-carbon content is about 4 percent in the surface layer. It drops to less than 1 percent in the subsoil. Most of the soils are leached of lime and soluble salts.

Granitic rocks, mainly granodiorite and quartz diorite, are dominant in this area (3). Bancas, Crouch, Kitchen Creek, La Posta, and Tollhouse soils developed in material weathered from these rocks. Their texture ranges from loamy coarse sand to stony loam. The rocky Crouch, La Posta, and Tollhouse soils have very large, light-colored granitic boulders on the surface and are shallow to deep over decomposed granite.

Gabbro, or basic intrusive rock, occurs as islands in the Mountains. It has weathered to a considerable depth. The moderately deep to deep Bommer soils were derived from this material. They have a

surface layer of loam and contain many angular, stone-size fragments. There are no boulders.

Micaceous schist, which is strongly metamorphosed, occurs as bands tilted nearly vertically. Holland and Sheephead soils were derived from this material. Both are steep to very steep and have a surface layer of fine sandy loam. Holland soils are deep and have a clay subsoil. Sheephead soils are shallow.

Young granitic alluvium was derived predominantly from granitic rocks. It is loamy coarse sand to coarse sandy loam in texture and is fairly well sorted. It occurs on alluvial fans and in narrow drainageways. The Mottsville soils in the Mountains were derived from this material. Calpine soils were derived from slightly older granitic alluvium.

Arkose, which is a form of old granitic alluvium, is sandy loam in texture. It occurs in broad basins in the Mountains. Bull Trail soils were derived from this material.

Desert

The Desert, which lies in the rain shadow to the east of the Mountains, is an area of recent, nearly level to moderately sloping alluvial fans and plains (fig. 8). It includes areas of Borrego badlands, lacustrine deposits, and very rocky barren hills.

The Desert receives the least precipitation and has the least vegetation in the entire survey area. There is not enough plant cover to control erosion. Precipitation diminishes rapidly down the abrupt eastern slopes of the Mountains. The amount of rainfall is variable. Total annual rainfall ranges from less than 5 inches to no more than 10 inches; for long periods there may be very little precipitation.

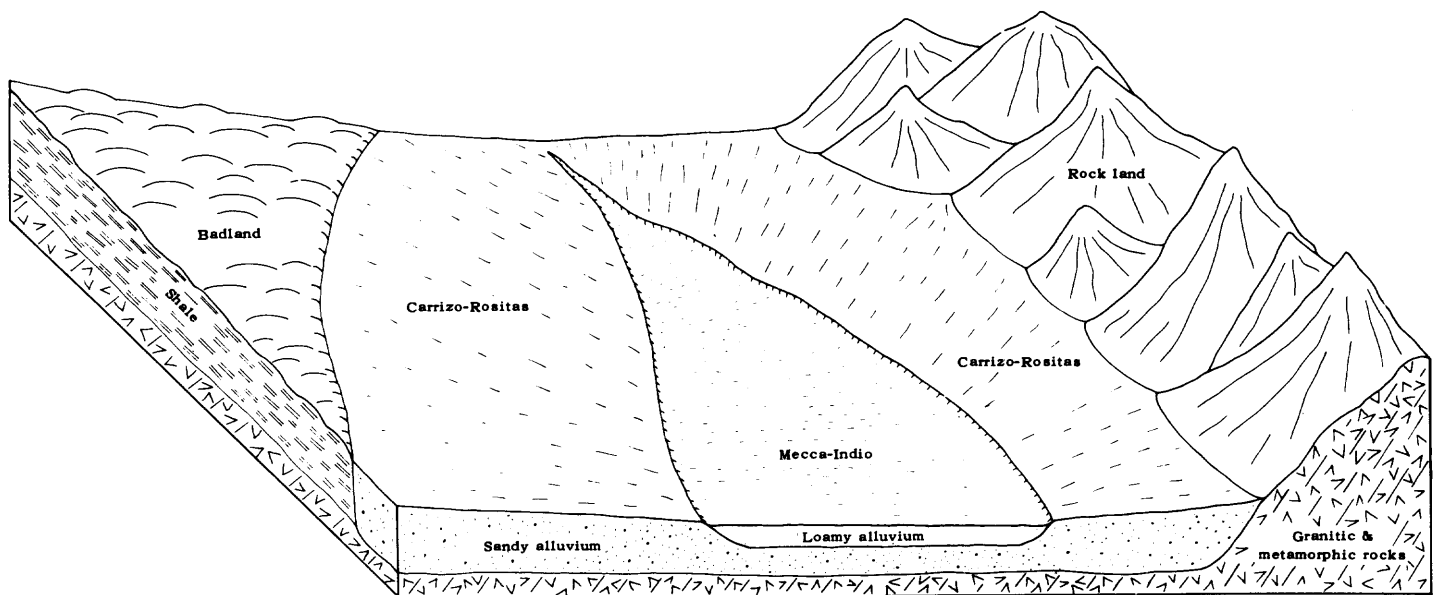


Figure 8.--Typical pattern of soils and underlying material of the Desert.

The Desert has a wide range of seasonal and daily temperatures. The mean annual temperature is 72° F., and the mean minimum temperature in January is 36°. The high temperature increases the rate of oxidation, so the organic-carbon content of the soils is very low. The frost-free season is 240 to 270 days. Soils in the Desert show little soil development because of lack of moisture. They tend to be alkaline, because most of the moisture evaporates and leaves dissolved salts.

Granitic rocks in this area occur as barren hills of rock outcrops or large, light-colored granitic boulders that have very little soil material between them. These hills are mapped as Acid igneous rock land.

Young granitic alluvium was derived predominantly from granitic rocks. It is very gravelly sand to loamy coarse sand in texture and is fairly well sorted. It occurs in broad basins, on alluvial fans, and in narrow drainageways. Some of this material washes down the steep slopes of the Mountains; the rest is from the granitic rock in the Desert. The Carrizo and Rositas soils in the Desert developed in young granitic alluvium.

Recent mixed alluvium was derived from igneous rocks and micaceous schist. It has been deposited on alluvial fans. This material is finer textured than young granitic alluvium and has been deposited more slowly. It ranges in texture from coarse sandy loam to silt loam. Indio and Mecca soils were derived from recent mixed alluvium.

The shales, sandstones, and conglomerates in the Desert form essentially barren areas that are cut by numerous intermittent drainage channels. These areas are mapped as Badland.

The essentially barren, flat areas of lacustrine deposits are Playas. These deposits are clayey or silty in texture and are typically moderately to strongly saline. Playas form in closed basins in the Desert. Some contain shallow water for a short period after a rain.

Morphology and Classification of the Soils

The relative influence of each of the soil forming factors varies greatly within the Area. The result is many different kinds of soils. Each soil is recognized by morphological features that can be observed and measured. The absence or presence of these features and their degree of expression is the basis for soil separation and classification. The main processes in the development of the different soil morphological features are (1) weathering of parent material, (2) accumulation and decomposition of organic matter, and (3) translocation of mineral and organic matter (4).

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (1) and revised later (9). The system currently used by the National Cooperative Soil Survey was adopted in 1965 (12). It is under continual study. Readers interested in the development of the system should refer to the latest literature available (8).

The current system has six categories. Beginning with the most inclusive, these categories are the order, the suborder, the group, the subgroup, the family, and the series.

The soils of the San Diego Area have been classified according to the current system, which has been updated through amendments of July, 1968. Ten orders are recognized in the system; five orders are represented in the Area.

Table 3 shows the classification of each soil series in the survey area by family, subgroup, and order, according to the current system. Table 4 shows the laboratory data used in classifying the soils.

Descriptions of the orders and subgroups recognized in the Area follow.

Entisols

Entisols are young soils that show little, if any, alteration of the parent material. Five groups and seven subgroups in this order are recognized in the survey area: Typic Xerofluvents, Typic Torriorthents, Typic and Lithic Xerorthents, Typic Torripsamments, and Typic and Alfic Xeropsamments.

Typic Xerofluvents formed in recent alluvium in a climate that has a dry season of more than 60 days and a moist season of more than 90 days. The organic-matter content in these soils varies with increasing depth, as successive layers of soil material are deposited by floodwater. This subgroup is represented by Anderson soils, which formed in mixed alluvium that is more than 35 percent gravel or coarser material.

Typic Torriorthents formed in young alluvium in a dry climate. They are low in organic-matter content. This subgroup is represented by Indio, Mecca, and Carrizo soils. Indio soils developed in silty material that may have been reworked by wind in some areas. Mecca soils developed in sandy loam. Both are calcareous but generally lack accumulations of secondary lime. Carrizo soils developed in sandy alluvium that is more than 35 percent gravel or coarser material.

Xerorthents reflect little alteration of their parent material. They formed in a climate that has a warm dry season of more than 60 days and a moist season of more than 90 days. Typic Xerorthents are represented by Soboba soils, which formed in very gravelly alluvium; by Reiff soils, which formed in sandy loam or coarse silt loam that is more than 15 percent sand; and by Cienega soils, which are shallow and are similar to the decomposed granitic parent rock. These are examples of soils in which the rates of erosion and weathering have reached an equilibrium. Lithic Xerorthents are less than 20 inches deep over hard rock. They are examples of soils in which the loss of soil material through erosion almost keeps pace with weathering of the parent rock. Exchequer and Gaviota soils represent this subgroup.

Typic Torripsamments are sandy soils of dry climates and have a low organic-matter content. Rositas soils, which formed in deep sandy alluvium, represent this subgroup.

TABLE 3.--SOIL SERIES CLASSIFIED ACCORDING TO THE CURRENT SYSTEM OF CLASSIFICATION

Series	Family	Subgroup	Order
Altamont-----	Fine, montmorillonitic, thermic-----	Typic Chromoxererts-----	Vertisols.
Anderson-----	Loamy-skeletal, mixed, nonacid, thermic-----	Typic Xerofluvents-----	Entisols.
Arlington-----	Coarse-loamy, mixed, thermic-----	Haplic Durixeralfs-----	Alfisols.
Auld-----	Fine, montmorillonitic, thermic-----	Typic Chromoxererts-----	Vertisols.
Bancas-----	Fine-loamy, mixed, mesic-----	Typic Haploxeralfs-----	Alfisols.
Blasingame-----	Fine-loamy, mixed, thermic-----	Typic Haploxeralfs-----	Alfisols.
<u>1/</u> Bonsall-----	Fine, montmorillonitic, thermic-----	Haplic Natrixeralfs-----	Alfisols.
<u>1/</u> Boomer-----	Fine-loamy, mixed, mesic-----	Ultic Haploxeralfs-----	Alfisols.
<u>1/</u> Bosanko-----	Fine, montmorillonitic, thermic-----	Chromix Pelloxererts-----	Vertisols.
Bull Trail-----	Fine-loamy, mixed, mesic-----	Mollic Haploxeralfs-----	Alfisols.
<u>1/</u> Calpine-----	Coarse-loamy, mixed, mesic-----	Ultic Haploxerolls-----	Mollisols.
Carlsbad-----	Sandy, mixed, thermic-----	Haplic Durochrepts-----	Inceptisols.
Carrizo-----	Sandy-skeletal, mixed, hyperthermic-----	Typic Torriorthents-----	Entisols.
Chesterton-----	Fine, kaolinitic, thermic-----	Abruptic Durixeralfs-----	Alfisols.
Chino-----	Fine-loamy, mixed, thermic-----	Aquic Haploxerolls-----	Mollisols.
Cieneba-----	Coarse-loamy, mixed, nonacid, thermic, shallow.	Typic Xerorthents-----	Entisols.
Corralitos-----	Mixed, thermic-----	Typic Xeropsamments-----	Entisols.
<u>1/</u> Crouch-----	Coarse-loamy, mixed, mesic-----	Ultic Haploxerolls-----	Mollisols.
Diablo-----	Fine, montmorillonitic, thermic-----	Chromic Pelloxererts-----	Vertisols.
Elder-----	Coarse-loamy, mixed, thermic-----	Pachic Haploxerolls-----	Mollisols.
Escondido-----	Coarse-loamy, mixed, thermic-----	Typic Xerochrepts-----	Inceptisols.
Exchequer-----	Loamy, mixed, nonacid, thermic-----	Lithic Xerorthents-----	Entisols.
<u>1/</u> Fallbrook-----	Fine-loamy, mixed, thermic-----	Typic Haploxeralfs-----	Alfisols.
Friant-----	Loamy, mixed, thermic-----	Lithic Haploxerolls-----	Mollisols.
Gaviota-----	Loamy, mixed, nonacid, thermic-----	Lithic Xerorthents-----	Entisols.
Grangeville-----	Coarse-loamy, mixed, thermic-----	Aquic Haploxerolls-----	Mollisols.
Greenfield-----	Coarse-loamy, mixed, thermic-----	Typic Haploxeralfs-----	Alfisols.
<u>2/</u> Hambright-----	Loamy-skeletal, mixed, thermic-----	Lithic Haploxerolls-----	Mollisols.
<u>1/</u> Holland-----	Fine-loamy, mixed, mesic-----	Ultic Haploxeralfs-----	Alfisols.
Huerhuero-----	Fine, montmorillonitic, thermic-----	Haplic Natrixeralfs-----	Alfisols.
Indio-----	Coarse-silty, mixed, calcareous, hyper- thermic.	Typic Torriorthent-----	Entisols.
Indio, dark variant--	Coarse-silty, mixed, thermic-----	Cumulic Haploxerolls-----	Mollisols.
<u>1/</u> Kitchen Creek-----	Coarse-loamy, mixed, mesic-----	Typic Haploxerolls-----	Mollisols.
<u>1/</u> La Posta-----	Sandy, mixed, mesic-----	Entic Haploxerolls-----	Mollisols.
Las Flores-----	Fine, montmorillonitic, thermic-----	Haplic Natrixeralfs-----	Alfisols.
Las Posas-----	Fine, montmorillonitic, thermic-----	Typic Rhodoxeralfs-----	Alfisols.
<u>3/</u> Linne-----	Fine-loamy, mixed, thermic-----	Calcic Entic Haploxerolls.	Mollisols.
Marina-----	Mixed, thermic-----	Alfic Xeropsamments-----	Entisols.
Mecca-----	Coarse-loamy, mixed, calcareous, hyper- thermic.	Typic Torriorthents-----	Entisols.
Mottsville-----	Sandy, mixed, mesic-----	Entic Ultic Haploxerolls-----	Mollisols.
Olivenhain-----	Clayey-skeletal, kaolinitic-----	Ultic Palexeralfs-----	Alfisols.
Placentia-----	Fine, montmorillonitic, thermic-----	Haplic Natrixeralfs-----	Alfisols.
Ramona-----	Fine-loamy, mixed, thermic-----	Typic Haploxeralfs-----	Alfisols.

TABLE 3.--SOIL SERIES CLASSIFIED ACCORDING TO THE CURRENT SYSTEM OF CLASSIFICATION--Continued

Series	Family	Subgroup	Order
<u>1/</u> Redding-----	Fine, kaolinitic, thermic-----	Abruptic Durixeralfs----	Alfisols.
Reiff-----	Coarse-loamy, mixed, nonacid, thermic---	Typic Xerorthents-----	Entisols.
Rositas-----	Mixed, hyperthermic-----	Typic Torripsamments----	Entisols.
Salinas-----	Fine-loamy, mixed, thermic-----	Calcic Pachic Haploxerolls.	Mollisols.
San Miguel-----	Fine, montmorillonitic, thermic-----	Typic Natrixeralfs-----	Alfisols.
<u>1/</u> Sheephead-----	Loamy, mixed, mesic, shallow-----	Ultic Haploxerolls-----	Mollisols.
Soboba-----	Sandy-skeletal, mixed, thermic-----	Typic Xerorthents-----	Entisols.
Stockpen-----	Fine, montmorillonitic, thermic-----	Haplic Natrixeralfs----	Alfisols.
Tollhouse-----	Loamy, mixed, mesic, shallow-----	Entic Haploxerolls-----	Mollisols.
Tujunga-----	Mixed, thermic-----	Typic Xeropsamments----	Entisols.
Visalia-----	Coarse-loamy, mixed, thermic-----	Pachic Haploxerolls----	Mollisols.
<u>1/</u> Vista-----	Coarse-loamy, mixed, thermic-----	Typic Xerochrepts-----	Inceptisols.
Wyman-----	Fine-loamy, mixed, thermic-----	Typic Haploxeralfs-----	Alfisols.

1/
See laboratory analyses, table 4.

2/
The Hambright soils in the San Diego Area are taxadjuncts to the Hambright series. They have brighter colors, a more clayey subsoil, and fewer coarser fragments throughout the profile than is appropriate to the classification shown.

3/
The Linne soils in the San Diego Area are taxadjuncts to the Linne series. They have a thinner, darker colored A horizon than is appropriate to the classification shown.

Xeropsamments are deep and sandy and formed in a climate that has a warm dry season of more than 60 days and a moist season of more than 90 days. Typic Xeropsamments are low in organic-matter content. They are represented by the somewhat excessively drained Corralitos soils and the excessively drained Tujunga soils. Alfic Xeropsamments are deep sandy soils that have clay lamella in the subsoil. The cumulative thickness of the lamella is less than 15 inches. Marina soils, which formed in the loamy coarse sand of old beach ridges, represent this subgroup.

Typic Chromoxererts have a dark-colored surface horizon at least 12 inches thick and no distinct mottles in the uppermost 20 inches of soil material. Altamont and Auld soils represent this subgroup.

Chromic Pelloxererts have gray colors in the surface horizon. Bosanko and Diablo soils represent this subgroup. The laboratory data for the Bosanko soils, in table 4, shows that the soil sampled is lower in clay than is typical of the series and subgroup.

Inceptisols

Inceptisols have been in place long enough to show slight alteration of the parent material. The original rock structure has been destroyed, but little, if any, movement and accumulation of silicate clays has taken place within the soil profile. The two subgroups in San Diego County are Haplic Durochrepts and Typic Xerochrepts.

Haplic Durochrepts have few prominent characteristics other than a pan, which is weakly cemented by silica and is within a depth of 40 inches. Carlsbad soils represent this subgroup. They developed on weak ferruginous sandstone, have an iron-silica pan, and generally contain enough iron concretions to have a gravelly texture.

Vertisols

Vertisols are clayey soils that are more than 20 inches deep and that, in most years, crack to a depth of at least 20 inches unless irrigated. They also have other characteristics that result from shrinking and swelling, such as slickensides. The two subgroups recognized in the San Diego Area are Typic Chromoxererts and Chromic Pelloxererts. Both are in the suborder Xererts. This suborder occurs in a climate that has an average soil temperature of less than 72° F. The cracks in Xererts soils open and close once each year; they remain open for more than 60 days.

The Typic Xerochrepts in the survey area are well drained and formed in a climate that has a warm dry season of more than 60 days and a moist season of more than 90 days. Escondido soils and Vista soils represent this subgroup. Escondido soils are low in organic-matter content and have stronger chromas and redder hues in the subsoil than in the surface layer. Vista soils, as shown in table 4, are low in organic-matter content and have only a slight clay increase in the subsoil. The mixing of soil layers indicates that these soils have been strongly worked by ground squirrels and other burrowing animals.

Mollisols

Mollisols have a thick, dark-colored surface horizon that has moderate or strong structure. The organic-matter content of the surface layer is high, as shown by data in table 4 for the Crouch, Kitchen Creek, and La Posta soils. In fact, the organic content is sufficiently high that these soils retain their dark colors, even after many years of cultivation. Also, the structure persists after cultivation; at least, the soils are not hard when dry.

Only the Haploxeroll group is recognized in the San Diego Area. Haploxerolls formed in a climate that has a warm dry season of more than 60 days. They lack well-developed horizons of translocated clay. There are nine subgroups.

Typic Haploxerolls are sufficiently well drained that they are free of gray colors within a depth of 30 inches, and their water table is below a depth of 40 inches most of the year. Kitchen Creek soils represent this subgroup.

Aquic Haploxerolls have restricted drainage; either the water table is high for significant periods or there are gray colors in the uppermost 30 inches of soil material. Chino soils are somewhat poorly drained and developed in the medium textured to moderately fine textured alluvium of basins and flood plains. Grangeville soils also are somewhat poorly drained, but they developed in more permeable alluvium and have a seasonal high water table.

The Calcic Entic Haploxerolls in the survey area have a dark-colored surface layer less than 20 inches thick; secondary lime has accumulated in the lower part. The Linne soils in the Area represent this subgroup. The Linne soils of other areas have a soft, dark-colored surface horizon more than 20 inches thick.

The Calcic Pachic Haploxerolls in the Area have a soft, dark-colored surface layer more than 20 inches thick and have concentrations of secondary lime in the subsoil. Salinas soils represent this subgroup.

Cumulic Haploxerolls have a dark-colored surface layer more than 20 inches deep, generally thickened by recent deposition. This subgroup is represented by Indio soils, dark variant, which developed in silty alluvium.

Entic Haploxerolls have a subsoil that is little altered, if at all, from the original parent material or is loamy fine sand or even coarser textured. La Posta soils and Tollhouse soils represent this

subgroup. La Posta soils are coarse textured, as shown in table 4. Tollhouse soils are shallow and have only a soft, dark-colored surface layer over weathered rock.

The Entic Ultic Haploxerolls in the Area are sandy and have a base saturation of less than 75 percent. Mottsville soils represent this subgroup.

Lithic Haploxerolls are underlain by hard parent rock at a depth of less than 20 inches. Friant and Hambright soils represent this subgroup.

Pachic Haploxerolls have a soft, dark-colored surface layer that is more than 20 inches thick. Elder and Visalia soils represent this subgroup.

Ultic Haploxerolls have a base saturation of less than 75 percent in the uppermost 30 inches of the soil profile, as shown in table 4 for the Calpine, Crouch, and Sheephead soils. The Calpine soils in the survey area fit this subgroup. The Calpine soils of other areas, unless irrigated, are generally dry during periods when soil temperature is above 41° F.

Alfisols

Alfisols have been in place long enough for the movement and accumulation of silicate clays within the soil profile. They are characterized by a massive, hard surface layer and by horizons of clay accumulation that have high base saturation. See data in table 4 for the Bonsall, Fallbrook, and Redding soils. In the San Diego Area, there are five groups of Alfisols and nine subgroups. All are in the suborder Xerafrs. The soils have a mean annual temperature of less than 72° F., are dry for a 60-day period in summer, and do not have a seasonal high water table.

Durixeralfs have a pan cemented by silica within a depth of 40 inches and below the main horizon of clay accumulation. Abruptic Durixeralfs have more than 35 percent clay in the main horizon of accumulation, as indicated in the data for Redding soils in table 4. Chesterton soils also represent this subgroup. Haplic Durixeralfs have a silica pan, but it is not strongly developed. Arlington soils represent this subgroup.

The Haploxeralfs in the survey area have moderately developed horizons of translocated clay that is less than 15 percent extractable sodium. The Typic Haploxeralfs in the Area are well-drained soils that have a base saturation of more than 75 percent in the horizons of clay accumulation, as shown for Fallbrook soils in table 4. Also, in this subgroup are the Bancas, Blasingame, Greenfield, Ramona, and Wyman soils. Mollic Haploxeralfs have a dark-colored surface layer. They are represented by Bull Trail soils. Ultic Haploxeralfs have a base saturation of less than 75 percent in the main horizons of clay accumulation, as shown for Boomer and Holland soils in table 4.

The Natriferalfs in the Area have prismatic or blocky structure in the horizons of clay accumulation. Some parts of these horizons are more than 15 percent extractable sodium, as shown for Bonsall soils in table 4. In Typic Natriferalfs, represented by San Miguel soils, the upper half of the

horizons of clay accumulation is more than 15 percent extractable sodium. In Haplic Natrixeralfs, the upper half of the horizon of clay accumulation is less than 15 percent extractable sodium, as shown for Bonsall soils in table 4. Also, in this subgroup are the Huerhuero, Las Flores, Placentia, and Stockpen soils.

Ultic Paleixeralfs are well-drained soils that have a subsoil that is more than 35 percent clay and, in some parts, has less than 75 percent base saturation. This subgroup is represented by Olivenhain soils.

The Typic Rhodoxeralfs in the Area are well-drained soils that have red horizons of clay accumulation more than 6 inches thick. Las Posas soils represent this subgroup.

Laboratory Data

The physical and chemical properties of selected soils of twelve series in the San Diego Area are shown in table 4. The profiles of the soils are described in the section "Descriptions of the Soils." Samples were analyzed by the Soil Survey Laboratory, Soil Conservation Service, Riverside, Calif. Most of the determinations were made according to methods and procedures as outlined in Soil Survey Investigations Report No. 1 (13).

Methods of Sampling and Analysis

Soils were sampled in duplicate from freshly dug pits to a depth of 5 feet or more. Paired sites were located not less than 1 mile apart or more than 20 miles apart. Only the soil material of less than three-fourths inch in diameter was removed for laboratory use. If larger fragments were present, estimates were made of the amount of material that ranged from three-fourths inch to 3 inches in diameter.

All determinations, except those for bulk density and moisture retention at 1/3-atmosphere tension, were made on soil material less than 2 millimeters in diameter. The air-dry samples were crushed with a rolling pin and passed through a 2-millimeter, round-hole screen. The fraction greater than 2 millimeters to 3 inches in diameter is reported as a weight percentage of the total sample. Results are reported on an oven-dry basis.

Particle-size distribution was determined by pipette and sieve analyses. After treatment of the sample to remove organic matter and soluble salts, particles were dispersed with sodium hexametaphosphate and mechanical shaking.

Bulk density values, expressed in grams per cubic centimeter, are reported on the basis of fine earth fabric. Bulk density and the percent moisture retained at 1/3 bar were measured from plastic-coated clods equilibrated at a tension of 1/3 atmosphere. To determine the percent moisture held at 15 atmospheres of pressure, the fragmented soil was treated with an excess of water and then desorbed to the desired moisture level in a pressure membrane apparatus (11).

A saturated paste was formed by adding water to the soil until the mixture began to flow. The percent water at saturation represents a weight difference between the soil paste and an oven dry subsample. The water was removed from the soil paste by vacuum filtration.

Soil reaction, expressed as pH value, was analyzed by glass electrode.

The cation exchange capacity (NaOAc) was determined after the sample had been sodium saturated by mixing it with a solution of sodium acetate. The amount of exchangeable sodium that was later displaced by ammonium acetate extraction represents the cation exchange capacity. The exchangeable sodium was determined by flame analysis (5).

Extractable cations, or exchangeable cations, in nonsaline, noncalcareous soils, were extracted with neutral, normal ammonium acetate. Calcium was precipitated as an oxalate and titrated, magnesium was determined gravimetrically as magnesium pyrophosphate, sodium, and potassium were analysed by flame photometer. Extractable acidity or exchangeable hydrogen was displaced from the soil with triethanolamine and barium chloride at pH 8.2.

Electrical conductivity as an estimation of soluble salts in the saturation extract was measured by Wheatstone bridge. The conductivity is expressed in millimhos per centimeter at 25 degrees Centigrade (11).

The percent carbonate reported as equivalent to calcium carbonate was measured from the amount of carbon dioxide evolved on acidification of the soil sample.

Organic carbon was determined by acid-dichromate digestion and ferrous sulfate titration, using a modification of the Walkley-Black method (7).

The analytical data for each layer of soil in the various profiles sampled are given in table 4.

TABLE 4.--LABORATORY ANALYSES

[Analyses by Soil Survey Laboratory, Riverside, Calif. Samples analyzed were taken from profiles

Soil and sample number	Horizon	Depth	Particle-size distribution							Gravel (more than 2 mm.)
			Silt (0.05- 0.002 mm.)	Clay (less than 0.002 mm.)	Very coarse sand (2-1 mm.)	Coarse sand (1-0.5 mm.)	Medium sand (0.5- 0.25 mm.)	Fine sand (0.25- 0.1 mm.)	Very fine sand (0.1- 0.05 mm.)	
		In.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
Bonsall sandy loam:										
S64 Calif-37-3-1-----	A11	0 to 6	23.3	8.7	11.0	15.0	9.8	19.4	12.8	4
S64 Calif-37-3-2-----	A12	6 to 10	24.7	12.4	9.3	13.6	9.0	18.6	12.4	3
S64 Calif-37-3-3-----	B1t	10 to 14	18.7	38.9	6.0	8.3	5.9	13.0	9.2	4
S64 Calif-37-3-4-----	B21t	14 to 27	21.1	38.3	2.8	6.1	5.1	13.0	11.6	2
	^{1/}									
S64 Calif-37-3-5-----	B22tca	27 to 38	23.3	28.5	2.0	4.1	5.5	20.8	15.8	3
S64 Calif-37-3-6-----	B31t	38 to 48	17.2	18.5	1.6	7.4	10.3	28.7	16.3	1
S64 Calif-37-3-7-----	B32t	48 to 60	10.8	19.4	3.3	14.1	16.4	27.9	8.1	2
S64 Calif-37-3-8-----	IIC1	60 to 89	26.5	21.3	5.5	8.9	8.6	18.5	10.7	7
S64 Calif-37-3-9-----	IIC2	89 to 110	29.3	14.2	12.8	12.1	6.9	13.8	10.9	31
S64 Calif-37-3-10-----	IIC3	110 to 120	32.5	17.0	3.3	10.8	8.0	16.2	12.2	7
Boomer stony loam:										
S60 Calif-37-9-1-----	A11	0 to 3	41.0	22.0	2.6	5.5	4.1	13.0	11.8	10
S60 Calif-37-9-2-----	A12	3 to 8	40.3	22.9	2.1	5.5	4.3	13.0	11.9	15
S60 Calif-37-9-3-----	B1	8 to 16	39.4	23.1	1.2	4.4	3.8	14.9	13.2	3
S60 Calif 37-9-4-----	B21t	16 to 31	35.5	28.6	2.1	5.4	3.7	13.4	11.3	4
S60 Calif 37-9-5-----	B22t	31 to 46	29.5	32.3	2.2	7.0	4.9	13.7	10.4	7
S60 Calif 37-9-6-----	C1	46 to 57	22.7	20.9	3.2	13.0	8.8	20.7	10.7	6
Bosanko clay:										
S64 Calif-37-9-1-----	AP	0 to 5	28.9	^{2/} 20.6	4.9	10.8	8.5	15.6	10.7	4
S64 Calif-37-9-2-----	A11	5 to 18	24.0	^{2/} 37.0	3.9	8.5	6.3	12.0	8.3	9
S64 Calif-37-9-3-----	A12	18 to 23	19.4	^{2/} 37.2	7.3	10.7	6.7	11.7	7.0	11
	^{3/}									
S64 Calif-37-9-4-----	ACca	23 to 30	11.7	26.8	13.1	20.4	9.2	13.8	5.0	14
S64 Calif-37-9-5-----	C1	30 to 48	9.7	14.5	16.5	26.7	10.5	16.4	5.7	22
Calpine coarse sandy loam:										
S60 Calif-37-1-1-----	A11	0 to 3	20.1	6.9	16.2	16.0	8.5	18.9	13.4	^{4/} 23
S60 Calif-37-1-2-----	A12	3 to 12	19.4	7.5	15.7	18.1	9.2	18.0	12.1	^{4/} 22
S60 Calif-37-1-3-----	B21	12 to 19	17.1	9.3	15.3	18.6	9.5	19.1	11.1	^{4/} 24
S60 Calif-37-1-4-----	B22	19 to 34	20.6	11.2	9.7	16.3	8.0	20.4	13.8	^{4/} 20
S60 Calif-37-1-5-----	C1	34 to 48	15.2	7.8	12.6	21.8	10.5	21.0	11.1	^{4/} 21
S60 Calif-37-1-6-----	C2	48 to 64	4.7	7.6	25.6	35.8	11.4	12.1	2.8	14
S60 Calif-37-1-7-----	C3	64 to 72	4.5	8.4	14.8	42.5	13.9	12.8	3.1	21

See footnotes at end of table.

OF REPRESENTATIVE SOILS

described in section "Descriptions of the Soils." Dashes in columns indicate values not determined]

Bulk density	Moisture retention		Water at saturation	Saturated paste	Cation-exchange capacity (NaOAc)	Extractable cations (meq./100 gm. of soil)					Base saturation	Electrical conductivity (ECx10 ³)	Organic carbon
	1/3 bar	15 bars				Ca	Mg	H	Na	K			
Gm./cc.	Pct.	Pct.	Pct.	pH	Meq./100 gm. of soil						Pct.	Mmhos./cm.	Pct.
1.51	10.6	4.2	25.8	6.5	8.7	4.3	1.7	---	0.3	0.2	78	0.57	0.70
1.76	9.5	4.5	19.8	6.4	10.2	4.7	2.4	---	0.6	0.1	83	0.34	0.28
1.60	20.1	13.9	44.7	6.5	25.6	11.2	8.8	---	2.1	0.2	88	0.66	0.47
1.73	17.7	13.1	50.8	7.6	24.7	13.8	8.2	---	3.5	0.2	98	2.16	0.21
----	----	12.6	49.6	7.8	26.8	20.2	10.1	---	6.7	0.2	99	4.80	0.11
1.60	20.2	10.6	38.7	7.7	23.0	10.2	7.5	---	6.3	0.1	97	5.65	0.02
----	----	9.4	33.9	7.6	20.1	8.5	6.2	---	5.1	0.1	96	4.07	0.02
1.67	15.4	11.7	39.4	7.7	24.6	10.6	7.4	---	5.9	0.1	97	3.56	0.02
----	----	13.3	47.1	7.9	36.7	18.1	8.4	---	7.1	0.1	95	1.79	0.01
159	20.8	15.0	47.2	7.7	31.0	14.1	8.6	---	5.9	0.1	96	1.74	0.01
----	----	15.9	----	---	34.9	20.8	5.6	10.1	0.2	1.4	73	----	3.81
----	----	10.1	----	---	32.0	17.4	4.9	10.3	0.2	0.9	69	----	3.01
----	----	14.3	----	---	27.6	13.1	4.4	11.2	0.2	0.4	62	----	1.33
----	----	17.4	----	---	24.2	11.8	5.4	8.9	0.2	0.3	67	----	0.54
----	----	22.4	----	---	26.3	11.2	5.7	9.0	0.4	0.1	66	----	0.47
----	----	16.5	----	---	21.3	8.5	3.8	8.9	0.6	0.1	59	----	0.37
----	----	8.9	36.5	5.7	18.6	7.4	6.9	---	0.6	0.4	82	0.46	0.86
----	----	16.0	50.8	6.6	33.4	18.5	10.4	---	2.4	0.2	94	0.95	0.34
----	----	16.7	59.2	7.4	38.4	22.3	10.1	---	4.2	0.2	97	2.33	0.32
----	----	16.7	56.2	7.6	46.0	31.2	12.0	---	6.6	0.1	98	4.08	0.12
----	----	12.9	44.9	7.6	38.2	22.0	9.5	---	6.2	0.1	96	5.33	0.02
----	----	6.6	----	---	16.3	11.6	1.5	5.6	0.2	0.4	71	----	2.76
----	----	4.3	----	---	11.2	6.5	0.6	3.9	0.2	0.2	66	----	1.04
----	----	4.2	----	---	7.3	3.8	1.0	2.0	0.2	0.1	72	----	0.31
----	----	4.6	----	---	8.1	5.1	1.6	1.8	0.2	0.1	80	----	0.20
----	----	3.3	----	---	5.6	3.3	1.2	1.2	0.2	0.1	80	----	0.11
----	----	2.6	----	---	4.6	2.6	1.0	0.7	0.2	0.1	84	----	0.05
----	----	2.3	----	---	4.1	1.7	0.8	0.6	0.2	0.1	82	----	0.06

TABLE 4.--LABORATORY ANALYSES

Soil and sample number	Horizon	Depth	Particle-size distribution							Gravel (more than 2 mm.)
			Silt (0.05- 0.002 mm.)	Clay (less than 0.002 mm.)	Very coarse sand (2-1 mm.)	Coarse sand (1- 0.5 mm.)	Medium sand (0.5- 0.25 mm.)	Fine sand (0.25 0.1 mm.)	Very fine sand (0.1- 0.05 mm.)	
		<u>In.</u>	<u>Pct.</u>	<u>Pct.</u>	<u>Pct.</u>	<u>Pct.</u>	<u>Pct.</u>	<u>Pct.</u>	<u>Pct.</u>	<u>Pct.</u>
Crouch coarse sandy loam:										
S61 Calif-37-6-1-----	A11	0 to 3	23.0	11.4	11.7	23.3	8.8	14.7	7.1	$\frac{4}{20}$
S61 Calif-37-6-2-----	A12	3 to 13	23.5	12.1	10.0	21.9	8.9	15.8	7.8	$\frac{4}{18}$
S61 Calif-37-6-3-----	A-3	13 to 29	22.6	10.6	12.2	24.6	8.4	14.2	7.4	$\frac{4}{17}$
S61 Calif-37-6-4-----	B1	29 to 42	24.2	11.1	8.1	19.1	8.9	18.4	10.2	8
S61 Calif-37-6-5-----	B2	42 to 56	21.6	10.6	11.6	21.7	9.0	16.3	9.2	7
S61 Calif-37-6-6-----	C1	56 to 70	11.9	7.6	27.2	24.1	8.7	13.8	6.7	17
S61 Calif-37-6-7-----	C2	70 to 88	11.1	7.0	19.3	23.3	11.8	20.9	6.6	17
Fallbrook sandy loam:										
S64 Calif-37-2-1-----	A11	0 to 2	19.5	7.6	13.3	19.2	10.2	19.5	10.7	8
S64 Calif-37-2-2-----	A12	2 to 6	19.4	8.2	13.1	18.2	10.1	19.7	11.3	9
S64 Calif-37-2-3-----	B1	6 to 12	21.0	12.6	11.8	16.4	9.4	18.3	10.5	3
S64 Calif-37-2-4-----	B21t	12 to 20	19.5	26.1	11.6	12.1	7.6	14.1	9.0	4
S64 Calif-37-2-5-----	B22t	20 to 28	17.0	31.2	12.1	11.6	7.4	13.4	7.3	3
S64 Calif-37-2-6-----	B3	28 to 47	12.8	14.8	17.0	21.6	10.5	16.7	6.6	11
S64 Calif-37-2-7-----	C1	47 to 68	11.2	9.2	23.8	25.8	9.6	14.9	5.5	19
S64 Calif-37-2-8-----	C2	68 to 85	13.9	5.4	21.7	25.0	10.4	16.9	6.7	21
S64 Calif-37-2-9-----	C3	85 to 90	14.7	5.1	27.1	23.4	9.1	14.8	5.8	36
Holland fine sandy loam:										
S61 Calif-37-2-1-----	A11	0 to 3	23.9	8.7	1.7	5.7	5.3	33.0	21.7	$\frac{4}{18}$
S61 Calif-37-2-2-----	A12	3 to 10	24.4	8.8	1.8	5.2	4.4	32.3	23.1	$\frac{4}{16}$
S61 Calif-37-2-3-----	A3	10 to 20	25.3	9.8	1.4	4.6	4.2	29.1	25.6	$\frac{4}{15}$
S61 Calif-37-2-4-----	B21t	20 to 29	24.8	20.9	1.2	2.8	2.6	20.0	27.7	5
S61 Calif-37-2-5-----	B22t	29 to 35	31.3	20.3	0.3	1.1	1.0	14.0	32.0	0
S61 Calif-37-2-6-----	C1	35 to 50	31.6	11.4	0.2	0.9	1.1	19.1	35.7	0
S61 Calif-37-2-7-----	C2	50 to 64	23.6	8.8	3.2	4.4	3.1	21.4	35.5	3
Kitchen Creek loamy coarse sand:										
S61 Calif-37-4-1-----	A11	0 to 4	14.4	7.0	11.4	20.2	11.0	25.1	10.9	16
S61 Calif-37-4-2-----	A12	4 to 12	14.7	7.3	12.3	19.8	10.2	24.8	10.9	12
S61 Calif-37-4-3-----	A13	12 to 21	15.8	8.4	10.3	19.2	9.9	25.8	10.6	13
S61 Calif-37-4-4-----	B1	21 to 28	18.1	9.1	10.0	19.4	8.8	24.5	10.1	11
S61 Calif-37-4-5-----	B2t	28 to 42	19.3	13.0	9.3	16.7	9.1	23.1	9.5	7
S61 Calif-37-4-6-----	B3t	42 to 54	16.6	10.2	11.5	21.1	10.1	22.0	8.5	9
S61 Calif-37-4-7-----	C1	54 to 67	13.4	3.0	9.7	25.3	12.2	27.3	9.1	15
S61 Calif-37-4-8-----	C2	67 to 73	12.2	2.8	17.5	23.6	12.2	24.1	7.6	12

OF REPRESENTATIVE SOILS.--Continued

Bulk density	Moisture retention		Water at saturation	Saturated paste	Cation-exchange capacity (NaOAc)	Extractable cations (meq./100 gm. of soil)					Base saturation	Electrical conductivity (ECx10 ³)	Organic carbon
	1/3 bar	15 bars				Ca	Mg	H	Na	K			
Gm./cc.	Pct.	Pct.	Pct.	pH	Meq./100 gm. of soil						Pct.	Mmhos./cm.	Pct.
----	----	8.0	----	---	19.8	11.1	2.4	6.4	0.2	0.6	69	----	2.25
----	----	8.1	----	---	16.5	9.5	2.3	6.5	0.2	0.5	66	----	1.31
----	----	8.3	----	---	19.8	11.0	3.2	5.3	0.3	0.3	74	----	0.48
----	----	10.9	----	---	28.0	17.8	5.8	6.0	0.4	0.2	80	----	0.35
----	----	11.8	----	---	35.2	22.1	8.0	6.4	0.4	0.1	83	----	0.15
----	----	7.8	----	---	27.8	18.6	5.7	4.3	0.4	0.1	85	----	0.08
----	----	6.9	----	---	28.6	17.1	4.3	4.0	0.6	0.1	85	----	0.05
1.42	10.2	2.9	----	6.4	9.6	4.6	1.3	----	0.3	0.4	81	----	0.73
1.60	10.5	3.6	----	6.3	9.2	5.2	1.3	----	0.3	0.1	82	----	0.50
1.78	11.0	5.0	----	6.5	10.8	6.5	2.0	----	0.4	0.1	82	----	0.30
1.78	15.0	10.1	----	6.6	18.3	10.0	4.7	----	0.4	0.1	84	----	0.27
1.73	16.5	11.3	----	6.7	19.7	10.0	5.0	----	0.5	0.1	84	----	0.24
1.80	13.7	7.8	----	7.0	19.3	11.3	5.0	----	0.9	0.1	91	----	0.07
1.81	10.9	5.9	38.2	7.4	16.7	10.3	4.3	----	0.9	0.1	93	0.18	0.02
----	----	3.7	----	7.9	13.7	8.5	3.9	----	0.8	(5/)	94	----	0.01
----	----	4.2	44.1	7.9	15.1	9.4	3.7	----	0.9	0.2	95	0.07	0.02
----	----	6.7	----	---	19.8	9.0	1.3	10.3	0.2	0.4	51	----	4.21
----	----	4.9	----	---	12.0	4.8	0.9	5.3	0.2	0.3	55	----	1.14
----	----	5.2	----	---	7.9	3.5	1.1	3.0	0.1	0.3	62	----	0.30
----	----	10.0	----	---	11.4	5.4	1.6	4.1	0.2	0.5	65	----	0.26
----	----	12.7	----	---	15.2	7.1	1.7	4.5	0.2	0.5	68	----	0.30
----	----	10.7	----	---	17.1	10.6	1.8	4.7	0.4	0.2	73	----	0.18
----	----	7.4	----	---	16.4	10.4	1.8	3.9	0.3	0.1	77	----	0.13
----	----	4.8	----	---	14.9	9.5	0.6	4.7	0.2	0.3	69	----	2.29
----	----	4.0	----	---	11.2	7.7	0.6	2.8	0.1	0.3	76	----	1.34
----	----	3.9	----	---	8.9	5.4	0.4	1.9	0.2	0.4	77	----	0.55
----	----	4.1	----	---	7.7	4.3	0.5	1.5	0.1	0.2	77	----	0.27
----	----	5.8	----	---	8.7	5.6	1.0	2.0	0.2	0.1	77	----	0.13
----	----	5.5	----	---	10.3	6.2	1.4	1.6	0.3	0.1	83	----	0.11
----	----	3.2	----	---	7.0	3.9	1.1	1.0	0.3	0.1	84	----	0.05
----	----	3.0	----	---	6.1	2.7	1.7	1.0	0.3	0.1	83	----	0.05

TABLE 4.--LABORATORY ANALYSES

Soil and sample number	Horizon	Depth	Particle-size distribution							Gravel (more than 2 mm.)
			Silt (0.05- 0.002 mm.)	Clay (less than 0.002 mm.)	Very coarse sand (2-1 mm.)	Coarse sand (1-0.5 mm.)	Medium sand (0.5- 0.25 mm.)	Fine sand (0.25- 0.1 mm.)	Very fine sand (0.1- 0.05 mm.)	
		<u>In.</u>	<u>Pct.</u>	<u>Pct.</u>	<u>Pct.</u>	<u>Pct.</u>	<u>Pct.</u>	<u>Pct.</u>	<u>Pct.</u>	<u>Pct.</u>
La Posta loamy coarse sand:										
S60 Calif-37-5-1-----	A11	0 to 2	15.1	6.2	13.3	26.1	10.4	19.5	9.4	21
S60 Calif-37-5-2-----	A12	2 to 7	17.1	7.6	12.0	23.2	9.6	20.2	10.3	13
S60 Calif-37-5-3-----	A13	7 to 10	16.9	9.8	10.4	22.6	9.7	20.9	9.7	12
S60 Calif-37-5-4-----	C1	10 to 20	5.7	4.7	29.0	38.5	8.6	10.8	2.7	27
S60 Calif-37-5-5-----	C2	20 to 29	8.1	4.5	17.5	31.4	13.2	18.5	6.8	21
S60 Calif-37-5-6-----	C3	29 to 37	9.5	6.2	19.1	30.3	11.5	17.7	5.7	23
S60 Calif-37-5-7-----	C4	37 to 46	9.3	8.1	22.2	29.1	11.0	15.2	5.1	24
Redding gravelly loam:										
S66 Calif-37-2-1-----	A11	0 to 4	33.5	11.2	2.9	15.7	18.0	13.7	5.0	22
S66 Calif-37-2-2-----	A12	4 to 15	35.9	11.3	3.1	12.9	17.1	13.8	5.9	14
S66 Calif-37-2-3-----	B1	15 to 18	27.3	37.4	1.6	8.3	11.2	10.0	4.2	8
S66 Calif-37-2-4-----	B2t	18 to 30	15.6	60.2	1.0	6.0	7.6	6.7	2.9	6
S66 Calif-37-2-5-----	C1m	30 to 36	7.1	27.6	17.4	21.8	11.9	10.9	3.3	14
Sheephead rocky fine sandy loam:										
S60 Calif-37-7-1-----	A11	0 to 4	17.9	6.3	5.7	11.6	8.3	32.7	17.5	16
S60 Calif-37-7-2-----	A12	4 to 8	21.7	6.5	3.9	12.0	7.7	31.0	17.2	10
S60 Calif-37-7-3-----	C1	8 to 24	19.0	4.7	1.7	6.4	7.7	36.0	24.5	1
S60 Calif-37-7-4-----	C2	24 to 40	17.3	7.5	3.7	10.6	9.6	31.9	19.4	0
S60 Calif-37-7-5-----	C3	40 to 51	24.3	6.1	1.6	7.2	7.3	31.9	21.6	0
Vista coarse sandy loam:										
S64 Calif-37-1-1-----	A11	0 to 3	17.1	10.2	19.5	21.2	9.0	14.8	8.2	$\frac{4}{19}$
S64 Calif-37-1-2-----	A12	3 to 9	18.5	10.6	17.8	18.0	9.0	17.2	8.9	$\frac{4}{22}$
S64 Calif-37-1-3-----	A13	9 to 19	18.2	11.5	18.2	18.4	8.9	16.0	8.8	$\frac{4}{23}$
S64 Calif-37-1-4-----	B21t	19 to 28	19.4	11.9	16.2	17.0	8.6	16.3	10.6	24
S64 Calif-37-1-5-----	B22t	28 to 35	18.5	10.9	19.5	18.0	8.5	16.1	8.5	28
S64 Calif-37-1-6-----	C1	35 to 44	12.5	5.2	35.3	23.2	6.9	11.8	5.1	41
S64 Calif-37-1-7-----	C2	44 to 61	12.5	4.6	32.5	23.9	7.8	12.9	5.8	40

$\frac{1}{\text{CaCO}_3}$ equivalent 3 percent.

$\frac{2}{\text{Lower than modal concept for series.}}$

$\frac{3}{\text{CaCO}_3}$ equivalent 1 percent.

OF REPRESENTATIVE SOILS.--Continued

Bulk density	Moisture retention		Water at saturation	Saturated paste	Cation-exchange capacity (NaOAc)	Extractable cations (meq./100 gm. of soil)					Base saturation	Electrical conductivity (ECx10 ³)	Organic carbon
	1/3 bar	15 bars				Ca	Mg	H	Na	K			
Gm./cc.	Pct.	Pct.	Pct.	pH	Meq./100 gm. of soil						Pct.	Mmhos./cm.	Pct.
----	----	7.1	----	---	14.4	11.0	1.5	5.3	0.1	0.6	71	----	3.33
----	----	5.0	----	---	16.1	12.9	1.4	2.9	0.1	0.5	84	----	1.90
----	----	4.9	----	---	12.8	9.9	1.4	1.5	0.1	0.5	89	----	1.14
----	----	2.6	----	---	4.4	2.7	0.7	0.5	0.1	0.3	88	----	0.12
----	----	3.2	----	---	5.3	3.0	0.8	1.1	0.1	0.2	79	----	0.08
----	----	4.8	----	---	12.2	9.1	2.0	1.7	0.1	0.1	87	----	0.05
----	----	5.5	---	---	14.6	10.5	2.4	1.7	0.2	0.1	89	----	0.05
1.27	9.6	5.5	----	5.6	11.1	5.2	2.1	----	0.4	0.6	58	----	2.51
1.65	9.8	3.7	----	5.5	6.8	4.3	2.4	----	0.4	0.3	68	----	0.63
1.59	20.3	12.2	----	4.6	16.6	3.3	5.5	----	1.8	0.2	52	----	0.41
1.47	26.8	20.6	----	4.3	28.6	5.5	10.4	----	4.1	0.2	56	----	0.38
1.69	17.0	15.8	----	4.3	29.4	5.1	9.5	----	4.9	0.2	58	----	0.35
----	----	6.7	----	---	15.5	10.1	1.3	5.5	0.1	0.5	69	----	4.09
----	----	4.5	----	---	9.6	5.2	1.2	2.5	0.1	0.3	73	----	0.83
----	----	3.9	----	---	6.7	3.1	1.0	1.8	0.1	0.2	71	----	0.26
----	----	4.2	----	---	7.3	3.5	1.2	2.2	0.1	0.2	69	----	0.12
----	----	5.9	----	---	11.9	6.3	2.2	3.0	0.2	0.1	75	----	0.15
1.55	8.7	5.4	----	6.7	16.9	10.5	3.4	----	1.4	0.2	90	----	0.96
1.51	9.8	4.0	----	6.5	18.6	10.5	2.8	----	0.4	0.1	86	----	0.56
1.46	12.0	3.1	----	6.6	19.8	13.0	4.0	----	0.4	0.1	89	----	0.34
1.43	10.1	3.7	----	6.6	19.1	11.1	4.0	----	0.4	0.1	89	----	0.28
1.46	10.9	6.4	----	6.7	22.8	13.5	5.1	----	0.4	0.1	90	----	0.10
1.92	6.7	4.6	44.4	7.2	14.9	9.1	3.7	----	0.5	(5/)	92	0.08	0.03
----	----	4.2	----	7.3	16.2	9.0	3.7	----	0.7	0.2	92	----	0.03

4/
Exceeds amount designated in series description.

5/
Trace.

LIST OF PLANT NAMES

<u>Common name</u>	<u>Scientific name</u>	<u>Common name</u>	<u>Scientific name</u>
Alkali heath	Frankenia grandiflora	Jeffrey pine	Pinus Jeffreyi
Anise	Foeniculum vulgare	Laurel leaf sumac	Rhus laurina
Australian saltbush	Atriplex semibaccata	Manzanita	Arctostaphylos spp.
Barley	Hordeum spp.	Mesquite	Prosopis juliflora var. torreyana
Big Galleta	Hilaria rigida	Mountain-mahogany	Cercocarpus betuloides
Big sagebrush	Artemisia tridentata	Mouse barley	Hordeum murinum
Black brush	Coleogyne ramosissima	Mustard	Brassica spp.
Black oak	Quercus kelloggii	Needlegrass	Stipa spp.
Black sage	Salvia mellifera	Oak	Quercus spp.
Blue wildrye	Elymus glauca	Oak brush	Quercus dumosa
Burclover	Medicago hispida	Ocotillo	Fouquieria splendens
Burroweed	Aplopappus fruticosus	Palo verde	Cercidium floridum
Bur-sage	Franseria dumosa	Pickelweed	Suaeda spp.
Cactus	Opuntia spp.	Ponderosa pine	Pinus ponderosa
California live oak	Quercus agrifolia	Red brome	Brome rubens
California sagebrush	Artemisia californica	Red shank	Adenostoma sparsifolium
Canyon live oak	Quercus chrysolepis	Ripgut brome	Bromus rigidus
Catclaw acacia	Acacia greggii	Russian-thistle	Salsola kali
Ceanothus	Ceanothus spp.	Ryegrass	Lolium multiflorum
Chamise	Adenostoma fasciculatum	Sage	Artemisia spp.
Cheatgrass	Bromus tectorum	Saltbush	Atriplex spp.
Cholla cactus	Opuntia spp.	Saltgrass	Distichlis spicata var. stricta
Coast live oak	Quercus agrifolia	Scrub oak	Quercus dumosa
Coffeeberry	Rhamnus californica	Soft chess	Bromus mollis
Coulter pine	Pinus Coulteri	Star-thistle	Centaurea spp.
Creosotebush	Larrea divaricata	Stipa	Stipa spp.
Cutleaf filaree	Erodium cicutarium	Sugarbush	Rhus ovata
Desert ceanothus	Ceanothus greggii	Sumac	Rhus spp.
Desert needlegrass	Stipa speciosa	Tarweed	Hemizonia spp.
Elm brush	Cercocarpus betuloides	Vinegarweed	Trichostema lanceolatum
Eucalyptus	Eucalyptus spp.	White sage	Salvia apiana
Filaree	Erodium cicutarium	Wild oats	Avena fatua
Flattop buckwheat	Eriogonum fasciculatum	Wild-rye	Elymus spp.
Foxtail	Hordeum spp.	Yerba santa	Eriodictyon spp.
Golden bush	Haplopappus spp.	Yucca	Yucca spp.
Incense-cedar	Libocedrus decurrens		
Ironwood	Olneya tesota		

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GLOSSARY

- Aggregate, soil.** Many fine particles held in a single mass or cluster. Natural soil aggregates such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.
- Alluvium.** Soil material, such as sand, silt, or clay, that has been deposited on land by streams.
- Available water holding capacity** (also water-holding capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.
- Base saturation.** The degree to which material that has base-exchange properties is saturated with exchangeable cations other than hydrogen, expressed as a percentage of the cation-exchange capacity.
- Bedrock.** The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.
- Calcareous soil.** A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.
- Chroma, color.** The relative purity, strength, or saturation of a color; directly related to the dominance of the determining wave length of the light, and inversely related to grayness. One of the three variables of color. See Munsell color system.
- Clay.** As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.
- Clay film.** A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.
- Claypan.** A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.
- Cobblestone.** Rock or mineral fragment 3 to 10 inches in diameter.
- Colluvium.** Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are--

Loose--Noncoherent when dry or moist; does not hold together in a mass.

Friable--When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm--When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic--When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky--When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard--When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft--When dry, breaks into powder or individual grains under very slight pressure.

Cemented--Hard and brittle; little affected by moistening.

Depth, effective soil. The depth of soil material that plant roots can penetrate readily to obtain water and plant nutrients. It is the depth to a layer that differs sufficiently from the overlying material in physical or chemical properties to prevent or seriously retard the growth of roots.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color

in the A and upper B horizons and have mottling in the lower B and the C horizons. Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches, in the lower A horizon and in the B and C horizons.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Exped. Most roots and pores follow interfaces between adjacent peds.

Floodplain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Fragipan. A loamy, brittle, subsurface horizon that is very low in organic matter and clay but is rich in silt or very fine sand. The layer is seemingly cemented. When dry, it is hard or very hard and has a high bulk density in comparison with the horizon or horizons above it. When moist, the fragipan tends to rupture suddenly if pressure is applied, rather than to deform slowly. The layer is generally mottled, is slowly or very slowly permeable to water, and has few or many bleached fracture planes that form polygons. Fragipans are a few inches to several feet thick; they generally occur below the B horizon, 15 to 40 inches below the surface.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material may be sandy or clayey, and it may be cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon--The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon--The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon--The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by

prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.--The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.--Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Hue. One of the three variables of color. The dominant spectral (rainbow) color; it is related to the dominant wavelength of the light. See Munsell notation.

Igneous rock. Rock that has been formed by the cooling of molten mineral material. Examples: Granite, syenite, diorite, and gabbro.

Indurated (soil). Having a hard brittle consistency because the particles are held together by cementing substances such as humus, calcium carbonate, or the oxides of silicon, iron, and aluminium. The hardness and brittleness persist even when wet.

Inped. Most roots and pores are within the peds.

Krotovinas. Irregular tubular streaks within one horizon of material transported, by burrowing animals, from another horizon. They appear as rounded or elliptical areas of various sizes. They generally have color and texture contrasting with the horizon in which they are located.

Leaching. The removal of soluble materials from soils or other material by percolating water.

Made land. Areas filled artificially with earth, trash, or both.

Mapping unit. Areas of soil of the same kind outlined on the soil map and identified by a symbol.

Metamorphic rock. Rocks of any origin that have been completely changed physically by heat, pressure, and movement. Such rocks are nearly always crystalline.

Mima-mound. A surface micro relief of a body of soil containing a series of rounded low mounds of one soil type, and concave intermound areas of a different soil type.

Montmorillonite. A fine, platy, alumino-silicate clay mineral that expands and contracts with the absorption and loss of water. It has a high cation-exchange capacity and is plastic and sticky when moist.

Munsell notation. A system for designating color by degrees of the three simple variables--hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability. The quality of a soil horizon that enables water or air to move through it.

Terms used to describe permeability are as follows: very slow, slow, moderately slow, moderate, moderately rapid, rapid, and very rapid.

pH value. A numerical means for designating relatively weak acidity or alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Playa. A strongly saline old lake basin in the arid regions.

Plowpan. A compacted layer formed in the soil immediately below the plowed layer.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

pH

Extremely acid-----	Below 4.5
Very strongly acid-----	4.5 to 5.0
Strongly acid-----	5.1 to 5.5
Medium acid-----	5.6 to 6.0
Slightly acid-----	6.1 to 6.5
Neutral-----	6.6 to 7.3
Mildly alkaline-----	7.4 to 7.8
Moderately alkaline-----	7.9 to 8.4
Strongly alkaline-----	8.5 to 9.0
Very strongly alkaline-----	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Runoff (hydraulics). The part of the precipitation upon a drainage area that is discharged from the area in stream channels. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil that contains soluble salts in amounts that impair growth of plants but that does not contain excess exchangeable sodium.

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters. Most sand grains consists of quartz, but they may be of any mineral composition. The textural class name of any soil

- that is 85 percent or more sand and not more than 12 percent clay.
- Silt.** Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.
- Slickensides.** Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on relatively steep slopes and in swelling clays, where there is marked change in moisture content.
- Soil.** A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.
- Structure, soil.** The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are--platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are (1) single grain (each grain by itself, as in dune sand) or (2) massive (the particles adhering together without any regular cleavage, as in many claypans and hardpans).
- Subsoil.** Technically, the B horizon; roughly, the part of the solum below plow depth.
- Substratum.** Technically, the part of the soil below the solum.
- Surface soil.** The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.
- Taxadjuncts.** Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their usefulness or behavior.
- Terrace (geological).** An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.
- Texture, soil.** The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."
- Water table.** The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

GUIDE TO MAPPING UNITS

For complete information about a mapping unit, read the description of the mapping unit and that of the soil series to which the mapping unit belongs. Both are in Part I.

Acreage and extent are given in Part I, table 2, page 19. All interpretations are given in Part II, in tables as follows:

Homesites, table 1, page 2.	Engineering, table 13, page 42, table 14, page 48, and table 16, page 63.
Sources of construction material, table 5, page 14.	Crops, table 21, page 80.
Recreation, table 7, page 20.	Average yields, table 22, page 84.
Land management, table 11, page 32.	

Numbers in parentheses designate land resource areas. Dashes indicate soil is not suitable for use indicated.

Storie index ratings are explained in Part II on page 92. The symbol < means less than.

Map symbol	Mapping unit	Part I on page	Capability unit	Part II on page	Range site	Part II on page	Storie index
AcG	Acid igneous rock land-----	18	VIIIIs-1(19,20,30)	106	-----	-----	<10
AtC	Altamont clay, 5 to 9 percent slopes-----	23	IIe-5(19)	95	-----	-----	41
AtD	Altamont clay, 9 to 15 percent slopes-----	23	IIIE-5(19)	97	Clayey (19)	111	39
AtD2	Altamont clay, 9 to 15 percent slopes, eroded-----	23	IIIE-5(19)	97	Clayey (19)	111	28
AtE	Altamont clay, 15 to 30 percent slopes-----	18	IVe-5(19)	100	Clayey (19)	111	29
AtE2	Altamont clay, 15 to 30 percent slopes, eroded-----	24	IVe-5(19)	100	Clayey (19)	111	25
AtF	Altamont clay, 30 to 50 percent slopes-----	24	VIe-5(19)	103	Clayey (19)	111	10
AuC	Anderson very gravelly sandy loam, 5 to 9 percent slopes-----	24	IVs-4(19)	101	Loamy (19)	112	36
AuF	Anderson very gravelly sandy loam, 9 to 45 percent slopes-----	24	VIIs-7(19,20)	104	Loamy (19)	112	25
AvC	Arlington coarse sandy loam, 2 to 9 percent slopes-----	25	IIIE-8(19)	98	Loamy (19)	112	47
AwC	Auld clay, 5 to 9 percent slopes---	26	IIe-5(19)	95	Clayey (19)	111	47
AwD	Auld clay, 9 to 15 percent slopes--	26	IIIE-5(19)	97	Clayey (19)	111	39
AyE	Auld stony clay, 9 to 30 percent slopes-----	26	VIe-7(19)	103	Clayey (19)	111	29
BaG	Badland-----	26	VIIIE-1(30)	106	-----	-----	<10
BbE	Bancas stony loam, 5 to 30 percent slopes-----	27	VIe-7(20)	103	Loamy (20W)	112	36
BbE2	Bancas stony loam, 5 to 30 percent slopes, eroded-----	27	VIe-7(20)	103	Loamy (20W)	112	28
BbG	Bancas stony loam, 30 to 65 percent slopes-----	27	VIIIE-7(20)	105	Loamy (20W)	112	13
BbG2	Bancas stony loam, 30 to 65 percent slopes, eroded-----	27	VIIIE-7(20)	105	Loamy (20W)	112	11
BeE	Blasingame loam, 9 to 30 percent slopes-----	28	VIe-1(19)	102	Shallow Loamy (19)	114	43
BgE	Blasingame stony loam, 9 to 30 percent slopes-----	28	VIe-7(19)	103	Shallow Loamy (19)	114	30
BgF	Blasingame stony loam, 30 to 50 percent slopes-----	28	VIIIE-7(19)	105	Shallow Loamy (19)	114	15
B1C	Bonsall sandy loam, 2 to 9 percent slopes-----	29	IIIE-3(19)	97	Claypan (19)	111	51
B1C2	Bonsall sandy loam, 2 to 9 percent slopes, eroded-----	29	IVe-3(19)	100	Claypan (19)	111	41
B1D2	Bonsall sandy loam, 9 to 15 percent slopes, eroded-----	29	IVe-3(19)	100	Claypan (19)	111	39
BmC	Bonsall sandy loam, thick surface, 2 to 9 percent slopes-----	29	IIIE-3(19)	97	Claypan (19)	111	51

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Map symbol	Mapping unit	Part I on page	Capability unit	Part II on page	Range site	Part II on page	Storie index
BnB	Bonsall-Fallbrook sandy loams, 2 to 5 percent slopes-----	30	IIIe-3(19)	97	-----	-----	49
BoC	Boomer loam, 2 to 9 percent slopes-----	31	IIIe-1(20)	97	Loamy (20W)	112	57
BoE	Boomer loam, 9 to 30 percent slopes-----	31	VIe-1(20)	102	Loamy (20W)	112	50
BrE	Boomer stony loam, 9 to 30 percent slopes-----	31	VIe-7(20)	103	Loamy (20W)	112	35
BrG	Boomer stony loam, 30 to 65 percent slopes-----	30	VIIe-7(20)	105	Loamy (20W)	112	12
BsC	Bosanko clay, 2 to 9 percent slopes-----	31	IIIe-5(19)	97	Clayey (19)	111	32
BsD	Bosanko clay, 9 to 15 percent slopes-----	32	IIIe-5(19)	97	Clayey (19)	111	27
BsE	Bosanko clay, 15 to 30 percent slopes-----	32	IVe-5(19)	100	Clayey (19)	111	26
BtC	Bosanko stony clay, 5 to 9 percent slopes-----	32	IVe-5(19)	100	Clayey (19)	111	25
BuB	Bull Trail sandy loam, 2 to 5 percent slopes-----	33	IIIec-1(20)	98	Loamy (20W,20E)	112, 113	56
BuC	Bull Trail sandy loam, 5 to 9 percent slopes-----	33	IIIec-1(20)	98	Loamy (20W,20E)	112, 113	53
BuD2	Bull Trail sandy loam, 9 to 15 percent slopes, eroded-----	32	IVec-1(20)	101	Loamy (20W,20E)	112, 113	45
BuE2	Bull Trail sandy loam, 15 to 30 percent slopes, eroded-----	33	VIec-1(20)	104	Loamy (20W,20E)	112, 113	35
CaB	Calpine coarse sandy loam, 2 to 5 percent slopes-----	34	IVec-1(20)	101	Loamy (20W,20E)	112, 113	58
CaC	Calpine coarse sandy loam, 5 to 9 percent slopes-----	34	IVec-1(20)	101	Loamy (20W,20E)	112, 113	55
CaC2	Calpine coarse sandy loam, 5 to 9 percent slopes, eroded-----	34	IVec-1(20)	101	Loamy (20W,20E)	112, 113	49
CaD2	Calpine coarse sandy loam, 9 to 15 percent slopes, eroded-----	34	IVec-1(20)	101	Loamy (20W,20E)	112, 113	41
CbB	Carlsbad gravelly loamy sand, 2 to 5 percent slopes-----	35	IIIe-8(19)	98	Sandy (19)	113	23
CbC	Carlsbad gravelly loamy sand, 5 to 9 percent slopes-----	35	IIIe-8(19)	98	Sandy (19)	113	21
CbD	Carlsbad gravelly loamy sand, 9 to 15 percent slopes-----	35	IVe-8(19)	100	Sandy (19)	113	20
CbE	Carlsbad gravelly loamy sand, 15 to 30 percent slopes-----	35	VIe-8(19)	104	Sandy (19)	113	15
CcC	Carlsbad-Urban land complex, 2 to 9 percent slopes-----	35	-----	---	-----	-----	--
CcE	Carlsbad-Urban land complex, 9 to 30 percent slopes-----	36	-----	---	-----	-----	--
CeC	Carrizo very gravelly sand, 0 to 9 percent slopes-----	36	VIIIs-4(30)	106	Sandy (30)	114	12
CfB	Chesterton fine sandy loam, 2 to 5 percent slopes-----	36	IVe-3(19)	100	Acid Claypan (19)	110	34
CfC	Chesterton fine sandy loam, 5 to 9 percent slopes-----	37	IVe-3(19)	100	Acid Claypan (19)	110	32
CfD2	Chesterton fine sandy loam, 9 to 15 percent slopes, eroded-----	37	IVe-3(19)	100	Acid Claypan (19)	110	29
CgC	Chesterton-Urban land complex, 2 to 9 percent slopes-----	37	-----	---	-----	-----	--
ChA	Chino fine sandy loam, 0 to 2 percent slopes-----	38	I-1(19)	93	-----	-----	72
ChB	Chino fine sandy loam, 2 to 5 percent slopes-----	38	IIe-1(19)	94	-----	-----	68
CkA	Chino silt loam, saline, 0 to 2 percent slopes-----	38	IIIs-6(19)	96	-----	-----	72

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Part I on page	Capability unit	Part II on page	Range site	Part II on page	Storie index
C1D2	Cieneba coarse sandy loam, 5 to 15 percent slopes, eroded-----	39	VIe-1(19)	102	Shallow Loamy (19)	114	16
C1E2	Cieneba coarse sandy loam, 15 to 30 percent slopes, eroded-----	38	VIe-1(19)	102	Shallow Loamy (19)	114	15
C1G2	Cieneba coarse sandy loam, 30 to 65 percent slopes, eroded-----	39	VIIe-1(19)	104	Shallow Loamy (19)	114	6
CmE2	Cieneba rocky coarse sandy loam, 9 to 30 percent slopes, eroded--	39	VIIIs-8(19)	106	Shallow Loamy (19)	114	10
CmrG	Cieneba very rocky coarse sandy loam, 30 to 75 percent slopes---	39	VIIIs-8(19)	106	Shallow Loamy (19)	114	<5
CnE2	Cieneba-Fallbrook rocky sandy loams, 9 to 30 percent slopes, eroded-----	39					
	Cieneba-----	--	VIe-7(19)	103	Shallow Loamy (19)	114	18
	Fallbrook-----	--	VIe-7(19)	103	Loamy (19)	112	18
	Rock outcrop-----	--	VIIIs-1(19)	106	-----	-----	--
CnG2	Cieneba-Fallbrook rocky sandy loams, 30 to 65 percent slopes, eroded-----	39					
	Cieneba-----	--	VIIe-7(19)	105	Shallow Loamy (19)	114	7
	Fallbrook-----	--	VIIe-7(19)	105	Loamy (19)	112	7
	Rock outcrop-----	--	VIIIs-1(19)	106	-----	-----	--
Co	Clayey alluvial land-----	40	IIs-5(19)	96	-----	-----	44
Cr	Coastal beaches-----	40	VIIIw-4(19)	106	-----	-----	<10
CsB	Corralitos loamy sand, 0 to 5 percent slopes-----	41	IIIs-4(19)	98	-----	-----	64
CsC	Corralitos loamy sand, 5 to 9 percent slopes-----	41	IIIs-4(19)	98	-----	-----	61
CsD	Corralitos loamy sand, 9 to 15 percent slopes-----	40	IVs-4(19)	101	-----	-----	52
CtE	Crouch coarse sandy loam, 5 to 30 percent slopes-----	41	VIe-1(20)	102	Loamy (20W)	112	46
CtF	Crouch coarse sandy loam, 30 to 50 percent slopes-----	42	VIIe-1(20)	105	Loamy (20W)	112	19
CuE	Crouch rocky coarse sandy loam, 5 to 30 percent slopes-----	42	VIe-7(20)	103	Loamy (20W)	112	25
CuG	Crouch rocky coarse sandy loam, 30 to 70 percent slopes-----	42	VIIe-7(20)	105	Loamy (20W)	112	9
CvG	Crouch stony fine sandy loam, 30 to 75 percent slopes-----	42	VIIe-7(20)	105	Loamy (20W)	112	12
DaC	Diablo clay, 2 to 9 percent slopes-----	43	IIE-5(19)	95	-----	-----	42
DaD	Diablo clay, 9 to 15 percent slopes-----	43	IIIE-5(19)	97	Clayey (19)	111	37
DaE	Diablo clay, 15 to 30 percent slopes-----	43	IVE-5(19)	100	Clayey (19)	111	30
DaE2	Diablo clay, 15 to 30 percent slopes, eroded-----	43	IVE-5(19)	100	Clayey (19)	111	27
DaF	Diablo clay, 30 to 50 percent slopes-----	43	VIe-5(19)	103	Clayey (19)	111	13
DcD	Diablo-Urban land complex, 5 to 15 percent slopes-----	44	-----	---	-----	-----	--
DcF	Diablo-Urban land complex, 15 to 50 percent slopes-----	44	-----	---	-----	-----	--
DoE	Diablo-Olivenhain complex, 9 to 30 percent slopes-----	44					
	Diablo-----	--	IVE-5(19)	100	Clayey (19)	111	23
	Olivenhain-----	--	VIe-7(19)	103	Claypan (19)	111	23
EdC	Elder shaly fine sandy loam, 2 to 9 percent slopes-----	44	IIE-1(19)	94	-----	-----	65
EsC	Escondido very fine sandy loam, 5 to 9 percent slopes-----	45	IIIE-8(19)	98	Loamy (19)	112	51

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Part I on page	Capability unit	Part II on page	Range site	Part II on page	Storie index
FsD2	Escondido very fine sandy loam, 9 to 15 percent slopes, eroded---	45	IVe-8(19)	100	Loamy (19)	112	43
EsE2	Escondido very fine sandy loam, 15 to 30 percent slopes, eroded--	45	VIe-8(19)	104	Loamy (19)	112	32
EvC	Escondido very fine sandy loam, deep, 5 to 9 percent slopes-----	46	IIIE-1(19)	96	Loamy (19)	112	56
ExE	Exchequer rocky silt loam, 9 to 30 percent slopes-----	46	VIIIs-8(19)	106	Shallow Loamy (19)	114	<5
ExG	Exchequer rocky silt loam, 30 to 70 percent slopes-----	46	VIIIs-8(19)	106	Shallow Loamy (19)	114	<5
FaB	Fallbrook sandy loam, 2 to 5 percent slopes-----	47	IIe-1(19)	94	-----	-----	64
FaC	Fallbrook sandy loam, 5 to 9 percent slopes-----	47	IIIE-1(19)	96	Loamy (19)	112	57
FaC2	Fallbrook sandy loam, 5 to 9 percent slopes, eroded-----	47	IIIE-1(19)	96	Loamy (19)	112	51
FaD2	Fallbrook sandy loam, 9 to 15 percent slopes, eroded-----	48	IVe-1(19)	99	Loamy (19)	112	48
FaE2	Fallbrook sandy loam, 15 to 30 percent slopes, eroded-----	48	VIe-1(19)	102	Loamy (19)	112	35
FaE3	Fallbrook sandy loam, 9 to 30 percent slopes, severely eroded--	48	VIIe-1(19)	104	Shallow Loamy (19)	114	37
FeC	Fallbrook rocky sandy loam, 5 to 9 percent slopes-----	48	VIe-7(19)	103	Loamy (19)	112	33
FeE	Fallbrook rocky sandy loam, 9 to 30 percent slopes-----	48	VIe-7(19)	103	Loamy (19)	112	13
FeE2	Fallbrook rocky sandy loam, 9 to 30 percent slopes, eroded-----	48	VIe-7(19)	103	Loamy (19)	112	27
FvD	Fallbrook-Vista sandy loams, 9 to 15 percent slopes-----	48	IVe-1(19)	99	-----	-----	54
FvE	Fallbrook-Vista sandy loams, 15 to 30 percent slopes-----	49	VIe-1(19)	102	-----	-----	45
FwF	Friant fine sandy loam, 30 to 50 percent slopes-----	49	VIIIs-8(19)	106	Shallow Loamy (19)	114	5
FxE	Friant rocky fine sandy loam, 9 to 30 percent slopes-----	49	VIIIs-8(19)	106	Shallow Loamy (19)	114	8
FxG	Friant rocky fine sandy loam, 30 to 70 percent slopes-----	49	VIIIs-8(19)	106	Shallow Loamy (19)	114	<5
GaE	Gaviota fine sandy loam, 9 to 30 percent slopes-----	50	VIe-8(19)	104	Shallow Loamy (19)	114	11
GaF	Gaviota fine sandy loam, 30 to 50 percent slopes-----	50	VIIe-8(19)	105	Shallow Loamy (19)	114	<5
GoA	Grangeville fine sandy loam, 0 to 2 percent slopes-----	50	IIw-2(19)	95	-----	-----	81
GrA	Greenfield sandy loam, 0 to 2 percent slopes-----	51	IIIs-4(19)	95	-----	-----	90
GrB	Greenfield sandy loam, 2 to 5 percent slopes-----	51	IIe-1(19)	94	-----	-----	81
GrC	Greenfield sandy loam, 5 to 9 percent slopes-----	52	IIe-1(19)	94	-----	-----	77
GrD	Greenfield sandy loam, 9 to 15 percent slopes-----	52	IIIE-1(19)	96	Loamy (19)	112	69
HaG	Hambricht gravelly clay loam, 30 to 75 percent slopes-----	52	VIIe-7(19)	105	Shallow Loamy (19)	114	5
HmD	Holland fine sandy loam, 5 to 15 percent slopes-----	53	IVe-1(20)	99	Loamy (20W)	112	65
HmE	Holland fine sandy loam, 15 to 30 percent slopes-----	53	VIe-1(20)	102	Loamy (20W)	112	57
HnE	Holland stony fine sandy loam, 5 to 30 percent slopes-----	53	VIe-7(20)	103	Loamy (20W)	112	32
HnG	Holland stony fine sandy loam, 30 to 60 percent slopes-----	53	VIIe-7(20)	105	Loamy (20W)	112	11

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Map symbol	Mapping unit	Part I on page	Capability unit	Part II on page	Range site	Part II on page	Storie index
HoC	Holland fine sandy loam, deep, 2 to 9 percent slopes-----	54	IIIE-1(20)	97	Loamy (20W)	112	68
HrC	Huerhuero loam, 2 to 9 percent slopes-----	54	IIIE-3(19)	97	Claypan (19)	111	41
HrC2	Huerhuero loam, 5 to 9 percent slopes, eroded-----	55	IVe-3(19)	100	Claypan (19)	111	38
HrD	Huerhuero loam, 9 to 15 percent slopes-----	55	IVe-3(19)	100	Claypan (19)	111	36
HrD2	Huerhuero loam, 9 to 15 percent slopes, eroded-----	55	IVe-3(19)	100	Claypan (19)	111	36
HrE2	Huerhuero loam, 15 to 30 percent slopes, eroded-----	55	VIe-3(19)	103	Claypan (19)	111	32
HuC	Huerhuero-Urban land complex, 2 to 9 percent slopes-----	55	-----	---	-----	---	--
HuE	Huerhuero-Urban land complex, 9 to 30 percent slopes-----	55	-----	---	-----	---	--
InA	Indio silt loam, 0 to 2 percent slopes-----	56	I-1(30)	94	-----	---	85
InB	Indio silt loam, 2 to 5 percent slopes-----	56	IIe-1(30)	94	-----	---	81
IoA	Indio silt loam, saline, 0 to 2 percent slopes-----	56	IIIs-6(30)	99	Alkali Flats (30)	111	56
IsA	Indio silt loam, dark variant-----	56	I-1(30)	94	-----	---	86
KcC	Kitchen Creek loamy coarse sand, 5 to 9 percent slopes-----	57	IVec-4(20)	101	Sandy (20W,20E)	114	45
KcD2	Kitchen Creek loamy coarse sand, 9 to 15 percent slopes, eroded---	58	IVec-4(20)	101	Sandy (20W,20E)	114	45
LaE2	La Posta loamy coarse sand, 5 to 30 percent slopes, eroded-----	58	VIsc-4(20)	104	Granitic (20W,20E)	111, 112	26
LaE3	La Posta loamy coarse sand, 5 to 30 percent slopes, severely eroded-----	58	VIIe-1(20)	105	Granitic (20W,20E)	111, 112	13
LcE	La Posta rocky loamy coarse sand, 5 to 30 percent slopes-----	58	VIIe-7(20)	105	Granitic (20W,20E)	111, 112	15
LcE2	La Posta rocky loamy coarse sand, 5 to 30 percent slopes, eroded---	59	VIIe-7(20)	105	Granitic (20W,20E)	111, 112	15
LcF2	La Posta rocky loamy coarse sand, 30 to 50 percent slopes, eroded-----	59	VIIe-7(20)	105	Granitic (20W,20E)	111, 112	6
LdE	La Posta-Sheephead complex, 9 to 30 percent slopes-----	59	VIsc-4(20)	104	Granitic (20W,20E)	111, 112	13
	La Posta-----	--	VIe-7(20)	103	Loamy (20W,20E)	112, 113	13
	Sheephead-----	--	VIIIs-1(20)	106	-----	---	--
	Rock outcrop-----	--					
LdG	La Posta-Sheephead complex, 30 to 65 percent slopes-----	59	VIIe-7(20)	105	Granitic (20W,20E)	111, 112	5
	La Posta-----	--	VIIe-7(20)	105	Loamy (20W,20E)	112, 113	5
	Sheephead-----	--	VIIIs-1(20)	106	-----	---	--
	Rock outcrop-----	--					
LeC	Las Flores loamy fine sand, 2 to 9 percent slopes-----	60	IVe-3(19)	100	Claypan (19)	111	36
LeC2	Las Flores loamy fine sand, 5 to 9 percent slopes, eroded-----	60	IVe-3(19)	100	Claypan (19)	111	31
LeD	Las Flores loamy fine sand, 9 to 15 percent slopes-----	60	IVe-3(19)	100	Claypan (19)	111	34
LeD2	Las Flores loamy fine sand, 9 to 15 percent slopes, eroded-----	60	IVe-3(19)	100	Claypan (19)	111	29
LeE	Las Flores loamy fine sand, 15 to 30 percent slopes-----	61	VIe-3(19)	103	Claypan (19)	111	29

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Map symbol	Mapping unit	Part I on page	Capability unit	Part II on page	Range site	Part II on page	Storie index
LeE2	Las Flores loamy fine sand, 15 to 30 percent slopes, eroded-----	61	VIe-3(19)	103	Claypan (19)	111	26
LeE3	Las Flores loamy fine sand, 9 to 30 percent slopes, severely eroded-----	61	VIIe-1(19)	104	Claypan (19)	111	24
LfC	Las Flores-Urban land complex, 2 to 9 percent slopes-----	61	-----	---	-----	---	--
LfE	Las Flores-Urban land complex, 9 to 30 percent slopes-----	61	-----	---	-----	---	--
LpB	Las Posas fine sandy loam, 2 to 5 percent slopes-----	62	IIIe-1(19)	96	Loamy (19)	112	41
LpC	Las Posas fine sandy loam, 5 to 9 percent slopes-----	62	IIIe-1(19)	96	Loamy (19)	112	--
LpC2	Las Posas fine sandy loam, 5 to 9 percent slopes, eroded-----	62	IIIe-1(19)	96	Loamy (19)	112	34
LpD2	Las Posas fine sandy loam, 9 to 15 percent slopes, eroded-----	62	IVe-1(19)	99	Loamy (19)	112	33
LpE2	Las Posas fine sandy loam, 15 to 30 percent slopes, eroded-----	62	VIe-1(19)	102	Loamy (19)	112	26
LrE	Las Posas stony fine sandy loam, 9 to 30 percent slopes-----	62	VIe-7(19,20)	103	Loamy (19,20W)	112	24
LrE2	Las Posas stony fine sandy loam, 9 to 30 percent slopes, eroded---	63	VIe-7(19,20)	103	Loamy (19,20W)	112	21
LrG	Las Posas stony fine sandy loam, 30 to 65 percent slopes-----	61	VIIe-7(19,20)	105	Shallow Loamy (19, 114, 115 20W)	115	8
LsE	Linne clay loam, 9 to 30 percent slopes-----	63	IVe-1(19)	99	Clayey (19)	111	14
LsF	Linne clay loam, 30 to 50 percent slopes-----	63	VIe-1(19)	102	Clayey (19)	111	6
Lu	Loamy alluvial land-----	64	IIw-2(20)	95	Wet Meadow (20E&W)	115	61
LvF3	Loamy alluvial land-Huerhuero complex, 9 to 50 percent slopes, severely eroded-----	64	VIIIIs-1(19)	106	-----	---	23
Md	Made land-----	64	VIIIe-1(19)	106	-----	---	--
M1C	Marina loamy coarse sand, 2 to 9 percent slopes-----	64	IIIs-4(19)	98	-----	---	54
M1E	Marina loamy coarse sand, 9 to 30 percent slopes-----	65	IVs-4(19)	101	-----	---	45
MnA	Mecca coarse sandy loam, 0 to 2 percent slopes-----	65	IIs-4(30)	96	Loamy (30)	113	72
MnB	Mecca coarse sandy loam, 2 to 5 percent slopes-----	65	IIE-1(30)	94	Loamy (30)	113	69
MoA	Mecca sandy loam, saline, 0 to 2 percent slopes-----	65	IIIs-6(30)	99	Alkali Flats (30)	111	54
MpA2	Mecca fine sandy loam, 0 to 2 percent slopes, eroded-----	66	IIE-4(30)	95	Loamy (30)	113	77
MrG	Metamorphic rock land-----	66	VIIIIs-1(19,20)	106	-----	---	<10
MvA	Mottsville loamy coarse sand, 0 to 2 percent slopes-----	66	IVsc-4(20)	102	Sandy (20W,20E)	114	50
MvC	Mottsville loamy coarse sand, 2 to 9 percent slopes-----	66	IVsc-4(20)	102	Sandy (20W,20E)	114	45
MvD	Mottsville loamy coarse sand, 9 to 15 percent slopes-----	66	IVsc-4(20)	102	Sandy (20W,20E)	114	43
MxA	Mottsville loamy coarse sand, wet, 0 to 2 percent slopes-----	67	Vw-1(20)	102	Wet Meadow (20E&W)	115	45
OhC	Olivenhain cobbly loam, 2 to 9 percent slopes-----	67	VIe-7(19)	103	Claypan (19)	111	29
OhE	Olivenhain cobbly loam, 9 to 30 percent slopes-----	68	VIe-7(19)	103	Claypan (19)	111	20
OhF	Olivenhain cobbly loam, 30 to 50 percent slopes-----	68	VIIe-7(19)	105	Claypan (19)	111	10

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OkC	Olivenhain-Urban land complex, 2 to 9 percent slopes-----	68	-----	---	-----	---	--
OkE	Olivenhain-Urban land complex, 9 to 30 percent slopes-----	68	-----	---	-----	---	--
PeA	Placentia sandy loam, 0 to 2 percent slopes-----	69	IVs-3(19)	101	Claypan (19)	111	54
PeC	Placentia sandy loam, 2 to 9 percent slopes-----	68	IVe-3(19)	100	Claypan (19)	111	49
PeC2	Placentia sandy loam, 5 to 9 percent slopes, eroded-----	69	IVe-3(19)	100	Claypan (19)	111	44
PeD2	Placentia sandy loam, 9 to 15 percent slopes, eroded-----	69	IVe-3(19)	100	Claypan (19)	111	41
PfA	Placentia sandy loam, thick sur- face, 0 to 2 percent slopes-----	69	IIIs-3(19)	98	Claypan (19)	111	67
PfC	Placentia sandy loam, thick sur- face, 2 to 9 percent slopes-----	69	IIIe-3(19)	97	Claypan (19)	111	60
Py	Playas-----	69	VIIIw-6(30)	106	-----	---	<10
RaA	Ramona sandy loam, 0 to 2 percent slopes-----	70	I-1(19)	93	-----	---	81
RaB	Ramona sandy loam, 2 to 5 percent slopes-----	70	IIe-1(19)	94	-----	---	65
RaC	Ramona sandy loam, 5 to 9 percent slopes-----	70	IIIe-1(19)	96	Loamy (19)	112	58
RaC2	Ramona sandy loam, 5 to 9 percent slopes, eroded-----	71	IIIe-1(19)	96	Loamy (19)	112	51
RaD2	Ramona sandy loam, 9 to 15 per- cent slopes, eroded-----	71	IVe-1(19)	99	Loamy (19)	112	48
RcD	Ramona gravelly sandy loam, 9 to 15 percent slopes-----	71	IVe-1(19)	99	Loamy (19)	112	28
RcE	Ramona gravelly sandy loam, 15 to 30 percent slopes-----	71	VIe-1(19)	102	Loamy (19)	112	25
RdC	Redding gravelly loam, 2 to 9 percent slopes-----	71	VIe-3(19)	103	Acid Claypan (19)	110	19
ReE	Redding cobbly loam, 9 to 30 percent slopes-----	72	VIe-7(19)	103	Acid Claypan (19)	110	16
RfF	Redding cobbly loam, dissected, 15 to 50 percent slopes-----	72	VIIe-7(19)	105	Acid Claypan (19)	110	10
RhC	Redding-Urban land complex, 2 to 9 percent slopes-----	72	-----	---	-----	---	--
RhE	Redding-Urban land complex, 9 to 30 percent slopes-----	72	-----	---	-----	---	--
RkA	Reiff fine sandy loam, 0 to 2 percent slopes-----	73	I-1(19), IIIc-1(20)	93, 99	-----	---	95
RkB	Reiff fine sandy loam, 2 to 5 percent slopes-----	73	IIe-1(19), IIIe-1(20)	94, 97	-----	---	86
RkC	Reiff fine sandy loam, 5 to 9 percent slopes-----	73	IIe-1(19), IIIe-1(20)	94, 97	-----	---	77
Rm	Riverwash-----	73	VIIIw-4(19,20,30)	106	-----	---	<10
RoA	Rositas fine sand, 0 to 2 percent slopes-----	74	IVe-4(30)	100	Sandy (30)	114	56
RrC	Rositas fine sand, hummocky, 5 to 9 percent slopes-----	74	VIIe-4(30)	105	Sandy (30)	114	35
RsA	Rositas loamy coarse sand, 0 to 2 percent slopes-----	74	IVs-4(30)	102	Sandy (30)	114	44
RsC	Rositas loamy coarse sand, 2 to 9 percent slopes-----	74	IVs-4(30)	102	Sandy (30)	114	39
RsD	Rositas loamy coarse sand, 9 to 15 percent slopes-----	74	VIIIs-4(30)	106	Sandy (30)	114	37

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Map symbol	Mapping unit	Part I on page	Capability unit	Part II on page	Range site	Part II on page	Storie index
RuG	Rough broken land-----	74	VIIIE-1(19,20)	106	-----	---	<10
SbA	Salinas clay loam, 0 to 2 percent slopes-----	75	I-1(19)	93	-----	---	81
SbC	Salinas clay loam, 2 to 9 percent slopes-----	75	IIe-1(19)	94	-----	---	73
ScA	Salinas clay, 0 to 2 percent slopes-----	75	IIs-5(19)	96	-----	---	62
ScB	Salinas clay, 2 to 5 percent slopes-----	75	IIe-5(19)	95	-----	---	59
SmE	San Miguel rocky silt loam, 9 to 30 percent slopes-----	76	VIIe-8(19)	105	Acid Claypan (19)	110	19
SnG	San Miguel-Exchequer rocky silt loams, 9 to 70 percent slopes----	76					
	San Miguel-----	--	VIIe-8(19)	105	Acid Claypan (19)	110	8
	Exchequer-----	--	VIIe-8(19)	105	Shallow Loamy (19)	114	8
SpE2	Sheephead rocky fine sandy loam, 9 to 30 percent slopes, eroded---	77	VIe-7(20)	103	Loamy (20W,20E)	112, 113	<10
SpG2	Sheephead rocky fine sandy loam, 30 to 65 percent slopes, eroded--	77	VIIe-7(20)	105	Loamy (20W,20E)	112, 113	< 5
SrD	Sloping gullied land-----	77	VIIIe-1(30)	106	-----	---	<10
SsE	Soboba stony loamy sand, 9 to 30 percent slopes-----	78	VIe-7(20)	103	Sandy (20W)	114	24
StG	Steep gullied land-----	78	VIIIe-1(19,20)	106	-----	---	<10
SuA	Stockpen gravelly clay loam, 0 to 2 percent slopes-----	78	IIIs-3(19)	98	-----	---	36
SuB	Stockpen gravelly clay loam, 2 to 5 percent slopes-----	79	IIIs-3(19)	98	-----	---	34
SvE	Stony land-----	79	VIIIs-1(19,20)	106	-----	---	<10
TeF	Terrace escarpments-----	79	VIIIe-1(19,20,30)	106	-----	---	<10
Tf	Tidal flats-----	79	VIIIw-6(19)	106	-----	---	<10
ToE2	Tollhouse rocky coarse sandy loam, 5 to 30 percent slopes, eroded---	79	VIe-7(20)	105	Shallow Loamy (20W, 20E)	115	9
ToG	Tollhouse rocky coarse sandy loam, 30 to 65 percent slopes----	80	VIe-7(20)	105	Shallow Loamy (20W, 20E)	115	< 5
TuB	Tujunga sand, 0 to 5 percent slopes-----	80	IVs-4(19)	101	Sandy (19)	113	39
Ur	Urban land-----	81	-----	---	-----	---	--
VaA	Visalia sandy loam, 0 to 2 percent slopes-----	81	I-1(19)	93	-----	---	90
VaB	Visalia sandy loam, 2 to 5 percent slopes-----	81	IIe-1(19)	94	-----	---	81
VaC	Visalia sandy loam, 5 to 9 percent slopes-----	81	IIe-1(19)	94	Loamy (19)	112	73
VaD	Visalia sandy loam, 9 to 15 percent slopes-----	81	IIIE-1(19)	96	Loamy (19)	112	69
VbB	Visalia gravelly sandy loam, 2 to 5 percent slopes-----	81	IIe-1(19)	94	Loamy (19)	112	49
VbC	Visalia gravelly sandy loam, 5 to 9 percent slopes-----	82	IIe-1(19)	94	Loamy (19)	112	44
VsC	Vista coarse sandy loam, 5 to 9 percent slopes-----	83	IIIE-1(19)	96	Loamy (19)	112	45
VsD	Vista coarse sandy loam, 9 to 15 percent slopes-----	82	IVe-1(19)	99	Loamy (19)	112	43
VsD2	Vista coarse sandy loam, 9 to 15 percent slopes, eroded-----	83	IVe-1(19)	99	Loamy (19)	112	40
VsE	Vista coarse sandy loam, 15 to 30 percent slopes-----	83	VIe-1(19)	102	Loamy (19)	112	35
VsE2	Vista coarse sandy loam, 15 to 30 percent slopes, eroded-----	83	VIe-1(19)	102	Loamy (19)	112	33

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Map symbol	Mapping unit	Part I on page	Capability unit	Part II on page	Range site	Part II on page	Storie index
VsG	Vista coarse sandy loam, 30 to 65 percent slopes-----	83	VIIe-1(19)	104	Loamy (19)	112	14
VvD	Vista rocky coarse sandy loam, 5 to 15 percent slopes-----	83	VIe-7(19)	103	Loamy (19)	112	27
VvE	Vista rocky coarse sandy loam, 15 to 30 percent slopes-----	83	VIe-7(19)	103	Loamy (19)	112	22
VvG	Vista rocky coarse sandy loam, 30 to 65 percent slopes-----	83	VIIe-7(19)	105	Loamy (19)	112	9
WmB	Wyman loam, 2 to 5 percent slopes--	84	IIe-1(19)	94	Loamy (19)	112	81
WmC	Wyman loam, 5 to 9 percent slopes--	84	IIe-1(19)	94	Loamy (19)	112	77
WmD	Wyman loam, 9 to 15 percent slopes-----	84	IIIe-1(19)	96	Loamy (19)	112	69